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The bryoflora of Falls Branch Falls, Cherokee National Forest, Monroe County, Tennessee, USA

Sarah Marie Noble

To the Graduate Council:

I am submitting herewith a thesis written by Sarah Marie Noble entitled "The bryoflora of Falls Branch Falls, Cherokee National Forest, Monroe County, Tennessee, USA." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Botany.

David K. Smith, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Vice Provost and Dean of Graduate Studies

THE BRYOFLORA OF FALLS BRANCH FALLS,

CHEROKEE NATIONAL FOREST,

MONROE COUNTY, TENNESSEE, USA

A Thesis
Presented for the
Master of Science Degree
The University of Tennessee, Knoxville

Sarah Marie Noble

May 2003

DEDICATION

This thesis is dedicated in honor of the two people who always believed in me and encouraged me to be what ever I wanted to be when I grew up.

My Papa

John E. Noble
April 1945- April 1983

and

My Grandma

Alvina A. Noble
May 1911- November 2001

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ABSTRACT

The bryophytes of Falls Branch Falls were sampled over two field seasons, 2000-2001. Falls Branch Scenic Area lies within the Citico Wilderness of Cherokee National Forest, Monroe County, Tennessee, USA. One thousand eight hundred seventy one (1871) record entries from 707 samples collected contained 49 families; 91 genera and 145 species representing 79 mosses; 65 liverworts and one hornwort. This study resulted in 76 new Monroe County bryophyte records.

Bryophytes were sampled/inventoried within the riparian, spray and other wet zones of Falls Branch Falls, Cherokee National Forest, Monroe County, Tennessee. Environmental factors of substrate, moisture level and light intensity were noted. The streambed of Falls Branch was sampled along East, Center and West transects from 30 meters above the falls to a few meters beyond Split Rock Crossing, a distance of approximately 100 meters. Bryophyte components of each sample were identified and ranked according to approximate proportion present. The most intensively sampled environmental gradient was also the most abundant, shaded wet rock.

Phytogeography of the taxa present ranged from narrow Southern Appalachian endemics to cosmopolitan taxa and populations disjunct from Asia, Europe and the Pacific Northwest. Several taxa also exhibited northern/boreal or southern affinities.

Bryophytes were analyzed using SPSS TwoStep Cluster Analysis which sorted the taxa into 11 categorical clusters along environmental gradients. The same 11 clusters were generated using both the entire data set and only the most dominant taxa, sampled 25 times or more. The 11 clusters were arranged into a dendrogram of community, society, and facies structures based on environmental gradients and most dominant taxa.

The Pisces Community Analysis package, containing TWINSPAN and Reciprocal Averaging analytical programs were applied to the data for further analysis. These analyses delineated associations of taxa between Rock and Non-Rock substrates. Among Non-Rock substrates further distinctions existed comparing taxa affiliated with Soil, Humus, Logs, and Trees. A final analysis, comparing the dominant species associations of the east, center, and west transects of the riparian zone, did not support separate divisions of associated taxa within the zone.

"It is by studying the little things that we attain the great knowledge of having as little misery and as much happiness as possible."

--Johnson, 1762

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CHAPTER I
INTRODUCTION

Falls Branch Scenic area, formerly Falls Branch Botanical Reserve, is a relatively unspoiled natural area located in the Citico Creek Watershed of Monroe County, Tennessee. Current ownership and management is by the U.S. Forest Service, Cherokee National Forest, Tellico Ranger District. Falls Branch Falls is a prominent feature in the upper Citico Creek Watershed at an elevation of 1100 m (3700 ft.), where a narrow gorge has been cut into the Cambrian-aged bedrock.

Falls Branch Falls is located in the Big Junction Quad. north of TN State Highway 165, which connects Tellico Plains, TN with Robbinsville, NC (See Figure 1). The falls are located about one mile NNW of the place name Rattlesnake Rock and remain preserved by their remote location and uncelebrated presence. An unmarked trailhead leads from Hwy 165 [35° 21' 11" N; 84° 04' 02" N] over a low ridge and drops down into the gorge over a distance of approximately one-half mile. Because the trail terminates at the gorge and falls, it is infrequently visited, and only by knowledgeable hikers and campers who have discovered it. Mostly it is used for short day hikes, nature sight-seeing, and backpack camping near the waterfall. For most people it is simply a pleasant place to get away and see a beautiful waterfall surrounded by ancient trees and abundant wildflowers.

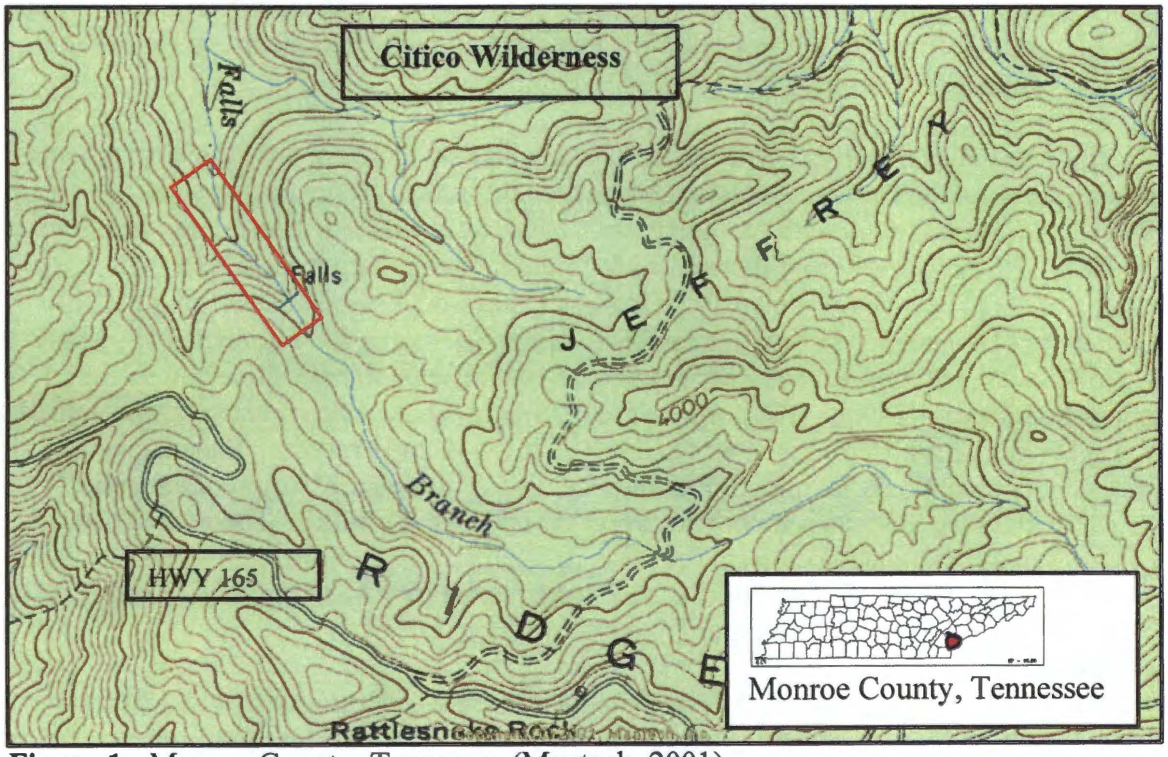


Figure 1: Monroe County, Tennessee (Maptech, 2001).

Falls Branch has received very little attention concerning inspection of the biotic diversity of the site. Only one study of the vascular plants of Citico Creek (Malter, 1977) included the falls site within a larger study area. No focused survey of the bryophytes of the gorge and falls has been conducted before this study although several bryologists have visited this site in the past and remarked on the quality of habitat and diverse flora present there (personal communication, D.K. Smith and P.G. Davison).

Falls Branch Falls is an excellent example of protected and remote gorges of the southern Blue Ridge. The gorges of the southern Blue Ridge are known for their rich bryophyte floras, containing many endemic and disjunct tropical species (Billings and Anderson, 1966). In these gorges, especially near the spray at the bottom of the waterfalls, occur the greatest proportions of endemic and disjunct bryophyte species. Many of the disjunct species found have either tropical or Asiatic affinities (Billings and Anderson, 1966). The number of endemic and disjunct species to be found in the gorges of the southern Blue Ridge was estimated in 1966 by Billings and Anderson to be close to 75 species.

Falls Branch Falls is located in a deep, narrow gorge, protected from high winds and extreme temperatures. The high walls of Falls Branch gorge combined with lush old-growth vegetation and perpetual spray from Falls Branch Falls maintain an average humidity near 100% in the gorge. According to Vitt and Belland (1997), this type of habitat is "the most influential landscape component for maintenance of rare species diversity of bryophytes". The high humidity, waterfall spray and protection from desiccating winds and extreme temperatures make the gorge an ideal habitat for common regional taxa and notable taxa representing elements of disjunct, endemic, edge of range, rare, and endangered status.

Although Falls Branch is bryofloristically very diverse there are only three specimens from the area in the University of Tennessee herbarium (TENN): one moss, *Heterocladium macounii*; and two liverworts, *Anastrophyllum michauxii* and *Plagiochila echinata*. No hornworts from the area were found in the herbarium database. A. J. Sharp collected bryophytes extensively in East Tennessee; however, according to the University of Tennessee herbarium database, he appears not to have collected anywhere in the Falls Branch gorge. The only bryologist who appears to have done any recorded amount of collecting within the gorge is Paul Davison whose 1995 findings are compiled in Table 1 along with TENN records and my own 2000-2001 records. Falls Branch gorge contains not only a high number of taxa but also a high proportion of endemic, sensitive and disjunct taxa with boreal, tropical and Asian affinities. There have been 145 bryophyte taxa identified from the Falls Branch Falls and gorge. The number of bryophyte taxa collected and identified is 79 mosses, 65 liverworts and one (1) hornwort (Sarah Marie Noble collections March 2000-November 2001).

The University of Tennessee bryophyte database presently contains 112 moss species, 67 liverwort species and two (2) hornwort species from Monroe County, Tennessee.

Table 1: List of hornwort, liverwort and moss taxa from Falls Branch Falls as listed in the records of Noble, Davison and TENN.

Taxon	Noble	Davison	Herbarium (TENN)
Hornwort			
Megaceros aenigmaticus	X		
Liverworts			
Anastrophyllum michauxii	X	X	X
Anastrophyllum minutum	X		
Bazzania trilobata	X		
Blepharostoma trichophyllum	X	X	
Calypogeia fissa	X		
Calypogeia muelleriana	X		
Calypogeia sullivantii	X		
Cephalozia bicuspidata	X		
Cephalozia connivens	X		
Cephalozia lunulifolia	X	X	
Cephaloziella byssacea	X		
Chiloscyphus appalachianus	X		
Chiloscyphus cuspidatus	X		
Chiloscyphus rivularis	X		
Cololejunea biddlecomiae	X		
Conocephalum conicum	X		
Diplophyllum apiculatum	X		
Drepanolejunea appalachiana	X		
Frullania asagrayana	X		
Frullania plana	X		
Harpalejunea ovata ssp. *integra*	X		
Harpanthus scutatus	X		
Herbertus aduncus ssp. *tenuis*	X	X	
Jamesoniella autumnalis	X	X	
Jubula pennsylvanica	X		
Jungermannia evansii		X	
Jungermannia lanceolata	X		
Kurzia sylvatica	X		
Lejunea laetevirens	X		
Lejunea lamacerina ssp. *geminata*	X	X	
Lejunea ruthii	X		
Lejunea ulicina ssp. *ulicina*	X		
Lepidozia reptans	X	X	
Leucolejunea clypeata	X		
Marsupella emarginata	X		
Marsupella paroica		X	

Table 1. Continued.

Taxon	Noble	Davison	Herbarium (TENN)
Marsupella sphacelata	X		
Metzgeria conjugata	X		
Metzgeria furcata	X		
Metzgeria leptoneura	X		
Nardia lescurii	X		
Nowellia curvifolia	X		
Odontoschisma denudatum	X		
Odontoschisma prostratum	X		
Pallavacinia lyellii	X		
Pellia epiphylla	X		
Plagiochila caduciloba	X	X	
Plagiochila europhyllon ssp. *echinata*	X	X	X
Plagiochila porelloides	X	X	
Plagiochila sullivantii	X	X	
Porella pinnata	X		
Porella platyphylloidea	X		
Porella wataugensis	X	X	
Radula obconica	X	X	
Radula sullivantii	X		
Radula tenax	X	X	
Riccardia multifida	X		
Riccardia palmata	X	X	
Scapania nemorosa	X		
Scapania undulata	X		
Solenostoma crenuliformis	X		
Solenostoma pumilum	X		
Solonostoma obscurum	X		
Trichocolea tomentella	X		
Tritomaria exsecta	X		
Tritomaria exsectiformis	X		
Mosses			
Andreaea rothii	X		
Anomodon attenuatus	X		
Anomodon rostratus	X		
Anomodon rugellii	X		
Atrichum undulatum	X		
Bartramia pomiformis	X		
Blindia acuta	X		
Brachythecium plumosum	X		
Brachythecium rivulare	X		
Brachythecium rutabulum	X		

Table 1. Continued.

Taxon	Noble	Davison	Herbarium (TENN)
Brachythecium salebrosum	X		
Brotherella recurvans	X		
Bryhnia novae-angliae	X		
Climacium americanum	X		
Cratoneuron filicinum	X		
Ctenidium malacodes	X		
Dicranella heteromalla	X		
Dicranodontium denudatum	X		
Dicranum fulvum	X		
Dicranum scoparium	X		
Dicranum viride	X		
Diphyscium cumberlandianum	X		
Eurhynchium hians	X		
Fissidens appalachensis	X		
Fissidens bryoides	X		
Fissidens dubius	X		
Fontinalis dalecarlica	X		
Haplohymenium triste	X		
Heterocladium macounii	X		X
Heterophyllium affine	X		
Hookeria acutifolia	X		
Hygrohypnum eugyrium	X		
Hygrohypnum luridum	X		
Hygrohypnum micans	X		
Hygrohypnum molle	X		
Hypnum curvifolium	X		
Hypnum fertile	X		
Hypnum imponens	X		
Hypnum pallescens	X		
Isopterygiopsis muelleriana	X		
Isopterygium tenerum	X		
Leucobryum albidum	X		
Leucobryum glaucum	X		
Leucodon julaceus	X		
Loeskeobryum brevirostre	X		
Mnium hornum	X		
Mnium thomsonii	X		
Neckera pennata	X		
Oncophorus rauii	X		
Oxystegus tenuirostris	X		
Philonotis fontana	X		

Table 1. Continued.

Taxon	Noble	Davison	Herbarium (TENN)
Plagiomnium ciliare	X		
Plagiothecium cavifolium	X		
Plagiothecium denticulatum	X		
Plagiothecium laetum	X		
Platylomella lescurii	X		
Playthypnidium riparioides	X		
Polytrichum pallidisetum	X		
Pseudotaxiphyllum distichaceum	X		
Pseudotaxiphyllum elegans	X		
Pylaisiadelpha tenuirostris	X		
Racomitrium aciculare	X		
Rhizomnium appalachianum	X		
Rhizomnium punctatum	X		
Schistidium rivulare var. *rivulare*	X		
Schwetschkeopsis fabronia	X		
Sematophyllum demissum	X		
Sematophyllum marylandicum	X		
Sphagnum flexuosum	X		
Sphagnum inundatum	X		
Sphagnum palustre	X		
Taxiphyllum deplanatum	X		
Taxiphyllum taxirameum	X		
Tetraphis pellucida	X		
Thamnobryum alleghaniense	X		
Thuidium delicatulum	X		
Tortella humilis	X		
Ulota crispa	X		
Weissia controversa	X		
Totals	145	18	3

This study has resulted in the addition of 76 new records of bryophytes for Monroe County. The new records will be added to the University of Tennessee herbarium and TENN database.

Purposes of the Study

The goals of this study were to:

1) Develop a comprehensive inventory of bryophytes for Falls Branch Falls;
2) Discern and describe a system of common bryophyte communities and associations;
3) Determine the presence of taxa of special interest and concern;
4) Analyze the phytogeographical relationships of the taxa;
5) Create a reference study for future spray zone bryological investigations;
6) Serve as a reference for assessment and management of conservation efforts within the Cherokee National Forest.

In addition, a comprehensive bryophyte inventory of Falls Branch Falls will serve as a valuable historical record for the State of Tennessee Department of Environment & Conservation Division of Natural Heritage. It will also function as a tool for the management and conservation planning of Cherokee National Forest.

CHAPTER II
HISTORY

Timber History

The first half of the 20th century brought about nearly constant change not only to the Falls Branch area but also to the entire Citico watershed. In 1902 the Smoky Mountain Timber & Improvement Company began timber improvement production. The company chose to extend their rail lines through Doublecamp Creek (Cherokee National Forest) to Slick Rock (Joyce Kilmer-Slick Rock Wilderness), thus allowing commercial timber harvest to extend into North Carolina. The rail lines were designed to serve up to six Shay locomotives (*Knoxville Journal and Tribune*, 1902; Arthur, 1914; Sulzer, 1975).

By the 1920's the last private timber holdings in the area were owned by the Babcock Boom & Lumber Company. There was a severe drought lasting the entire summer of 1925. As a result of the drought, a series of catastrophic fires occurred along the mountains from Johnson City to south of Cleveland. One of these fires was the Great Fire ignited in a logging slash near Jeffrey. The Great Fire burned for five days, September 5-10, 1925, destroying 7,000 ha of timber in the Citico Creek Wilderness area (*Chattanooga Daily Times*, 1925; *Knoxville Journal*, 1925). As a result of heavy losses in the Great Fire, Babcock Boom & Lumber removed all of their remaining rail lines in December 1925. Due to impenetrable post-fire growth of *Rhododendron maximum*, sporadic logging continued for only a decade. The last private timberland on the western slopes of the Unaka Mountains was cut over, leaving a few pockets of virgin timber including Falls Branch, before being sold to the federal government in 1936 (Maughan, 1939). Since 1936 there has been limited timber extraction coordinated by the U. S. Forest Service.

Protection and Conservation History

In 1939, only three years after being purchased by the U. S. Forest Service, the Falls Branch Botanical Reserve was set aside and designated for use in botanical research. Unfortunately, no botanical research was done in the area, so in 1953 the protective designation was generalized to Falls Branch Scenic Area.

In 1975 Citico Creek Wilderness Study Area was established and protected under the Eastern Wilderness Area Act. The Citico Creek Wilderness Study area included Falls Branch Scenic Area. Citico Creek Wilderness Study Area was set aside, in 1975, for a five year period of study while waiting for Congress to make a decision regarding the study area's inclusion in the National Wilderness System (Malter, 1977). In 1984 the area was included in the National Wilderness System (Murrell, 1985). In 1986 the Tennessee Wilderness Act brought "permanent" protection to Falls Branch Scenic Area and much of Cherokee National Forest.

In 2000 a $683,000 federal grant for Cherokee National Forest to build a visitor's center at the Monroe County end of the Cherohala Skyway has raised new concerns for the future of Falls Branch Falls and the organisms that live there (John Duncan, Personal Correspondence, 2000). Most notable of the threatened organisms living in the Falls Branch area are the rare and endemic salamanders and bryophytes both of which are ultra sensitive to environmental changes including pollution and human disturbance. Rare and endemic organisms have great intrinsic and genetic value to humankind.

History of Botanical Exploration and Investigation

Although Falls Branch was designated in 1939 as a reserve for botanical studies no formal botanical investigations were recorded under this specific botanical reserve designation.

Previous Vascular Plant Investigations

All of the formal botanical work done in the Citico watershed area has been on vascular plants. In 1977 Jeffry L. Malter completed a Master's thesis on the vascular flora of Citico Creek Wilderness Study Area. Malter's flora covered only vascular plants. In 1985 Zach E. Murrell completed a Master's thesis on the vascular flora of nearby Big Frog Mountain. The vascular flora of Gee Creek Wilderness was conducted as a Master's thesis in 1996 by Daniel L. Wyrick (Malter, 1977; Murrell, 1985; Wyrick, 1996).

Previous Bryological Investigations

Previous bryological investigations of Falls Branch Scenic Area include nonsystematic collections dating back to 1977 (TENN herbarium database). The University of Tennessee herbarium bryophyte database is presently the best resource for the bryophyte inventory of Cherokee National Forest. The earliest curated bryophyte collections from Cherokee National Forest, Monroe County, Tennessee are A. J. Sharp's collections beginning with a single moss specimen in 1932. The period of greatest bryophyte collection in Cherokee National Forest, Monroe County, Tennessee was 1944 to 1955 by Alfred Clebsch and A. J. Sharp. The most recent bryophyte collection efforts were by Marie Hicks and Paul Davison in 1994. A field trip to Falls Branch Scenic area was also taken during the Association of Southeastern Biologists annual meeting held in Knoxville in 1995 (P.G. Davison and L.S. Farmer, personal communication 2001).

CHAPTER III
PHYSIOGRAPHY AND GEOLOGY

Physiography

Falls Branch is located within the Citico watershed of the southern Blue Ridge Province. The Blue Ridge Province lies in the portion of the Appalachian Mountains south of the Roanoke River (Fenneman, 1938).

The southern Blue Ridge Province is described as having recently deepened gorges with very steep slopes (Fenneman, 1938). Associated with the deep gorges of the Blue Ridge Province are many small branches, several of which form waterfalls. Among the most beautiful of these is Falls Branch Falls in the Tellico district of Cherokee National Forest. Falls Branch flows into the South Fork of Citico Creek. Citico Creek is a tributary of the Little Tennessee River, which empties into the Tennessee River. The water from the Tennessee River joins the Ohio River before flowing down the Mississippi River into the Gulf of Mexico.

Geology

Falls Branch is located in the Unaka section of the Blue Ridge Province. A combination of igneous and highly metamorphosed Cambrian rocks make up the Unaka Mountain Range. The metamorphosed Cambrian rocks include quartzite, schist, slate and strong conglomerate which were over thrust on the limestone floor of the Great Valley (Fenneman, 1938).

The geology of the Citico Creek area is divided into two different sequences by the Nichols Cove Fault. Each of these sequences displays a different fold style. Falls Branch Scenic Area is located in the area southeast of the fault containing mostly dark graphitic slate and metagraywacke. Here the folding style is characterized as having inclined or upright closed folds. The folds are usually symmetric with either gentle or steep limbs. Some of the smaller folds are isoclinal (Slack et al., 1984).

The topography of the area reflects some of the larger isoclinal folds as exhibited by the anticlines at Grassy Gap and at the South Fork of Citico Creek (Slack et al., 1984). Some of these folds can be clearly seen in the road cuts along the Tellico-Robbinsville road (TN Hwy 165). In a few places tightly folded slate can be seen between unfolded beds of metagraywacke, these folds are interpreted by Slack et al. (1984) as a reflection of the processes of soft-sediment slumping.

No metallic mineral deposits of potential commercial value have been found in the Citico Creek Wilderness. All surface and mineral rights within the Citico Creek Wilderness are fully held by the U.S. Government, with the only exception being 72

hectare (177 acre) Falls Branch Scenic Area which is considered an easement (Slack et al., 1984).

Many of the rocks in Falls Branch Scenic area appear to contain concretions. Concretions contain high levels of calcium carbonate and appear as textured dark ellipses, measuring 1cm-1m, in the rock. Occasionally a slight elliptical depression will be found where the calcium carbonate has been leached out of the concretion. Concretions can be found where sediment has accumulated in a high-energy environment, and are formed when pieces of old rock are torn from their strata and mixed with sandy sediment. As calcium-rich water filters through the sandy sediment, calcium ions bond to the imbedded pieces of old rock thus forming calcium rich concretions. Concretions range in size from very small up to one meter in diameter (D. Byerly personal communication, 2001).

Soils in the southern district of Cherokee National Forest include Dystrochrepts, Hapludults, Haplumbrepts and Spodosols. The latter two are generally found at the highest elevations (Springer and Elder, 1980 in Griffith et al., 1997).

CHAPTER IV
STUDY SITE

The study site includes the portion of Falls Branch extending from 30 m above Falls Branch Falls to a point 10 meters down stream from Split Rock Crossing. Falls Branch Falls is located within the Falls Branch Scenic area of Citico Creek Wilderness Area in the Tellico district of Cherokee National Forest in Monroe County, Tennessee (Plumb, 1996).

Falls Branch Scenic Area is 72 hectares (177 acres) located northwest of the sandstone outcrop of Sassafras Ridge known as Rattlesnake Rock. It was characterized in 1977 by Malter as being blanketed with virgin forest dominated by mature beech and maple (Malter, 1977). The forest in Falls Branch Scenic Area is presently composed of many species of woody plants including the following: *Fagus grandifolia, Tsuga canadensis, Acer pensylvanicum, A. rubrum, A. saccharum, Prunus serotina, Rhododendron maximum, R. calendulaceum, Liriodendron tulipifera, Sassafras albidium, Hydrangea arborescens, Cercis canadensis,* and *Aesculus octandra* (=*A. flava*).

The coordinates for the geographic center of the study, Falls Branch Falls, are Big Junction Quad, TN, 35° 21' 20" N, 84° 03' 54" W (DeLorme, 1999), the terminal point of Cherokee National Forest Wilderness Trail #87 (USFS #87). The trail can be picked up by the million-dollar bridge on the Cherohala Skyway 2.25 km on the Tennessee side of the Tennessee-North Carolina border (Skelton, 1992).

The stream and falls are in an NNW orientation, flanked by steep N- and W-facing slopes as seen in Figure 2, page 14. The elevation varies from the top of the falls, 1131m (3710 ft.) to 1082m (3550 ft.) downstream. The elevation at the base of Falls Branch Falls is 1073 m (3645 ft.) above sea level.

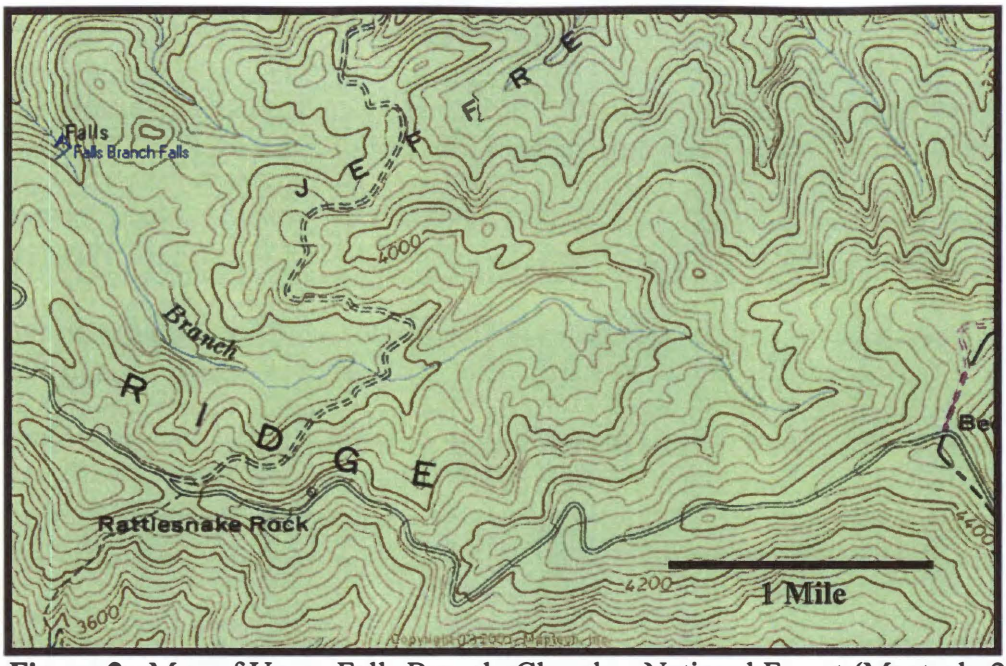


Figure 2: Map of Upper Falls Branch, Cherokee National Forest (Maptech, 2001).

CHAPTER V
CLIMATE

The Falls Branch area is located in the area of the Blue Ridge Mountains that receives the greatest mean annual precipitation, usually 140-190 cm (55-75 inches) per year. This area also has the highest number of frost-free days in the region, 170-200 days per year. The mean temperatures for the coldest month, January, are a low temperature of -4.44°C (24° F) and a high temperature of 8.33° (47° F). For July the mean temperatures are a low temperature of 16.11°C (61°F) and a high temperature of 30°C (86°F) (Griffith et al., 1997).

CHAPTER VI
METHODS

Collections were made on a semi-monthly basis. Collections were concentrated within approximately 10 m blocks along transects forming East, Center and West sections along Falls Branch beginning 30m above Falls Branch Falls (FBF) and continuing down stream to Split Rock Crossing (SR). Each transect collected was divided into East (E), Center (C), and West (W) sections. Plotless sampling was performed within each block until all apparent taxa had been sampled.

Specimen Data

Each collection was labeled with the following information:

- General area from which collection was taken

  FUFB= Far upper Falls Branch
  MUFB= Middle upper Falls Branch
  UFB= Area of Falls Branch above Falls Branch Falls
  FBFA= Area at top of the waterfall
  FBF= Falls Branch Falls waterfall area
  FBBP= Falls Branch below waterfall pool
  FBBP-2= Second area below waterfall pool
  FBBI= Falls Branch central island
  SRC= Split Rock Crossing
  E= east side and east edge of Falls Branch
  C= center of Falls Branch
  W= west side and west edge of Falls Branch

- Moisture level of samples

  A= aquatic; defined as being in or under moving water
  W= wet; defined as being saturated but not in or under moving water
  M= moist; defined as being hydrated enough to squeeze water from but not saturated
  D= damp; defined as being fully hydrated but not enough to squeeze water from, not dry
  C= dry; defined as having very little or no moisture, appearing somewhat to completely crisped or contorted

- Relative light intensity, insolation

  N= dark; defined as shade too deep to see more then outlines of material to the near absence of illumination

V= very deep shade; defined as shade too deep to distinguish most shades of green and brown but light enough to see a few details beyond basic outline
S= shade; defined as an area with enough light to see colors and shapes clearly but not receiving direct sunlight, faint shadows possible
R= diffused, filtered or reflected light; defined as direct sunlight diffused or filtered by trees and other vegetation or reflected, from a source such as a pool of water, directly onto an area
H= sun; defined as an area receiving direct sunlight, distinct shadows found

- Substrate upon which collection was growing

R= rock; mineral composition
MB= massive boulder
VF= vertical or steeply inclined rock face
VH= upper surface of rock/boulder
S = soil; organic or organic and mineral composition
H = humus
T =Trees, live and standing
L# = log; defined as a horizontal or semi-horizontal tree, dying or dead.
1= newly fallen log; possibly partially living, not yet beginning to show signs of decomposition; still hard
2= fallen log; no live twigs remaining, beginning to decay visibly
3= fallen log; nearly impossible to identify species of tree, decaying wood easily crumbles when touched, frequently also serving as a substrate for soft fungi

Each collection was also labeled with the following information:

- Primary, secondary, tertiary and lesser taxa components of the collection

1° = 60-100% of collection components
2° = 30-59% of collection components
3° = 10-29% of collection components
4°= 5-9% of collection components
5° = Scraps, less then 5% of collection components

- Any special status of the species in the collection

R= rare
E= endangered
L= local Endemic
N= northern/boreal affinity
S=southern/subtropical affinity

T= tropical affinity
A= Asian affinity

- Collection location including site, county and state
- Collector's name
- Collection number
- Collection date

Field collections were identified to species in the laboratory using a dissecting microscope and a compound microscope. Once species components were identified, data were stored in an Access database.

Nomenclature for mosses follows Crum and Anderson (1981) and the most recent checklists for North America, Anderson, Crum & Buck (1990) and Anderson (1990). For hepatics and hornworts, nomenclature follows Schuster's (1966, 1969, 1974, 1980, 1992) exhaustive multi-volume set on the North American species. The most recent checklist for hepatics and hornworts (Stotler and Crandall-Stotler, 1977) has been of some use. All names applied are in current use, and important synonyms of past literature are included for clarity in discussions.

All collections have been made in accordance with the requests and recommendations of Cherokee National forest as set forth in the 27 April 2000 letter of permission to collect. In accordance with these requests voucher specimens have been deposited in the herbarium at the University of Tennessee (TENN) in Knoxville, Tennessee.

As shown in Figure 3, any vascular flora and fauna of deemed importance or significance were noted in the field report for the day on which it was observed. Field reports also include temperature (at SRC), estimated flow of waterfall (very low, low, medium, high, very high) and estimated humidity (low, medium, high). Any new anthropogenic influences were noted.

After all collections were identified and data stored in the database, trends and patterns were noted and analyzed regarding the primary, secondary and tertiary component species and associations. Special attention was given to collections containing rare, endangered and/or local endemic taxa as well as those exhibiting other geographical affinities ((tropical, northern (boreal), southern, western and Asian)).

All incomplete entries were eliminated resulting in a remaining total of 1655 data entries and 145 taxa. Data were then run through Pisces and TWINSPAN statistical computer programs (Pisces Conservation, LTD, 2002). A statistical analysis was performed using SPSS TwoStep Cluster Number Crosstabulation as determined by Cary Springer, a professional consultant, at the University of Tennessee Statistical Consulting

Field Report

Cherokee National Forest, Tellico District
Date: 13 April 2001

Personnel: Sarah Marie Noble; Brian Arner

Location: Falls Branch

Objective: Collect Falls Branch below waterfall pool on west side. **FBBP-W**

Collections: **FBBP-W** Mosses: 2001M187- 2001M218;
Hepatics: 2001H152- 2001H159

Conditions: Waterfall: Very high.
Humidity: ~100%
Temperature: 68°F

Notes: Wild flowers observed
Dicentra canadensis
Dicentra cucullaria
Erythronium americanum
Red trillium (erect)
White trillium (erect)
Claytonia sp.
Lace cap hydrangea
Blue Violets
White Violets

Figure 3: Sample Field Report.

Center. Results from SPSS exhibited similar levels of precision using either the entire data set or the data set comprised of only taxa occurring 25 times or more. Results are presented and discussed for statistics performed only on data entries containing complete information for the 15 most frequently recorded taxa (Chapter VIII, p. 54).

CHAPTER VII
PHYTOGEOGRAPHY

Phytogeography, also known as geobotany and plant geography, is defined by Henderson, Henderson and Kenneth (1963) as the "study of the geographical distribution of plants." Bryologists have long held a keen interest in the phytogeography of bryophytes (Anderson and Zander, 1973; Crum, 1972; Delgadillo, 2000; Iwatsuki, 1958; Iwatsuki and Sharp, 1967; Delgadillo, 1969; Sharp, 1938, 1939, 1941, 1955, 1989; Schofield and Crum, 1972; Smith, 1974). Phytogeography is essential to management and conservation programs because a basic characteristic of plants is unevenness of geographical distribution. Phytogeography indicates which conditions a plant can tolerate and in which environments they can be expected to occur (Cox, Healey and Moore, 1976).

Categories of taxa distribution are recognized to emphasize taxa of greatest interest and/or importance in evaluating the significance of Falls Branch Scenic Area situated within the Citico Creek Wilderness area of Cherokee National Forest.

The categories are:

1. Taxa records for Cherokee National Forest and Monroe County, Tennessee.

2. Taxa of general or specific geographic affinity including:

    A) American elements including Eastern North American elements.
    B) Appalachian and Southern Appalachian endemics.
    C) North American-European disjunct elements.
    D) American-Asian disjunct elements.
    E) American-European-Asian disjunct elements.
    F) Elements having cosmopolitan distribution.
    G) Globally wide spread elements.
    H) Taxa exhibiting North American disjunction.
    I) Circumboreal/Northern (intercontinental and transcontinental, northern) elements.
    J) Caribbean elements.
    K) Southern Appalachian endemics.

Several new bryophyte records were added to Monroe County, Tennessee. Of the new Monroe County records 43 are mosses and 33 are hepatics, as shown in Table 2.

Table 3 shows the distribution of bryophytes from Falls Branch. Affinities and endemism are noted. Various categorical suites of bryogeographic affinities, disjunction patterns and Endemic taxa are defined and separated into tables included in this chapter.

Table 2: New bryophyte records for Monroe County, Tennessee.

New Monroe County Bryophyte Records	
Mosses	Hepatics
Anomodon rostratus	*Anastrophyllum minutum*
Anomodon rugellii	*Blepharostoma trichophyllum*
Blindia acuta	*Calypogeia fissa*
Brachythecium plumosum	*Calypogeia muelleriana*
Brachythecium rutabulum	*Calypogeia sullivantii*
Brachythecium salebrosum	*Cephalozia connivens*
Cratoneuron filicinum	*Cephaloziella byssacea*
Dicranodontium denudatum	*Chiloscyphus appalachianus*
Dicranum fulvum	*Chiloscyphus cuspidatus*
Dicranum scoparium	*Chiloscyphus rivularis*
Dicranum viride	*Drapanolejunea appalachiana*
Eurhynchium hians	*Harpanthus scutatus*
Fissidens appalachensis	*Herbertus aduncus* ssp. *tenuis*
Fissidens bryoides	*Jamesoniella autumnalis*
Heterophyllium affine	*Jungermannia lanceolata*
Hygrohypnum eugyrium	*Kurzia sylvatica*
Hygrohypnum luridum	*Lejunea lamacerina* ssp. *geminata*
Hygrohypnum micans	*Lepidozia reptans*
Hygrohypnum molle	*Marsupella emarginata*
Hypnum pallescens	*Metzgeria leptoneura*
Isopterygiopsis muelleriana	*Nardia lescurii*
Isopterygium tenerum	*Nowellia curvifolia*
Leucobryum albidum	*Odontoschisma denudatum*
Mnium thomsonii	*Plagiochila caduciloba*
Oncophorus rauii	*Plagiochila sullivantii*
Oxystegus tenuirostris	*Porella wataugensis*
Plagiomnium ciliare	*Radula sullivantii*
Plagiothecium cavifolium	*Radula tenax*
Plagiothecium laetum	*Riccardia palmata*
Polytrichum pallidisetum	*Solenostoma obscurum*
Pseudotaxiphyllum distichaceum	*Solenostoma pumilum*
Pylaisiadelpha tenuirostris	*Tritomaria exsecta*
Rhizomnium appalachianum	*Tritomaria exsectiformis*

Table 2. Continued.

New Monroe County Bryophyte Records	
Mosses	
Rhizomnium punctatum	
Schistidium rivulare var. *rivulare*	
Schwetschkeopsis fabronia	
Sematophyllum demissum	
Sphagnum flexuosum	
Sphagnum inundatum	
Sphagnum palustre	
Taxiphyllum deplanatum	
Taxiphyllum taxirameum	
Thamnobryum alleghaniense	

Table 3: Distribution of bryophytes including those exhibiting affinities and/or endemism.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Mosses												
Andreaea rothii	ENA; wna	X	X		X							
Anomodon attenuatus	NA			MX; CA	X					X		
Anomodon rostratus	NA			MX; CA	X	X				X		
Anomodon rugellii	ENA				X	X						
Atrichum undulatum	NA			MX; CA	X	X						AF
Bartramia pomiformis	ENA; wna		X	SA	X	X						AU
Blindia acuta	ENA; wna	X	X	CA; SA	X	X			X			AF; AU
Brachythecium plumosum	NA			MX; CA; nSA	X	X				X	X	NZ
Brachythecium rivulare	NA	X			X	X			X			AF; AU
Brachythecium rutabulum	NA			CA; SA	X	X					X	AF;AU; NZ
Brachythecium salebrosum	NA			MX	X	X						AU; NZ
Brotherella recurvans	ENA	X				X						

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Bryhnia novae-angliae	ENA; wna	X	X		X	X						
Climacium americanum	ENA		X			X						
Cratoneuron filicinum	NA	X		MX; ca; SA	X	X						AU; NZ
Ctenidium malacodes	NA		X	MX; SA	X	X			X	X		
Dicranella heteromalla	ENA; WNA		X	CA; nSA	X	X						AF
Dicranodontium denudatum	ENA; wna		X	CA	X	X					X	
Dicranum fulvum	ENA				X	X						
Dicranum scoparium	NA	X	X	MX; CA; SA	X	X			X			AF; AU; NZ
Dicranum viride	ENA				X	X						
Diphyscium cumberlandianum	ena							X				
Eurhynchium hians	ENA; wna			MX	X	X				X		
Fissidens appalachensis								X				
Fissidens bryoides	NA			MX; CA; SA	X	X				X		AF
Fissidens dubius	ENA; wna			MX	X	X			X	X		AF
Fontinalis dalecarlica	ENA; wna	X			X	X						
Haplohymenium triste	ENA			MX; CA; SA	X	X					X	

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Mosses												
Heterophyllium affine	sena			MX; CA; sa	X	X				X		
Hookeria acutifolia	ENA; wna		X	MX; CA; nSA		X				X	X	
Hygrohypnum eugyrium	ENA				X	X						
Hygrohypnum luridum	ENA; WNA	X	X		X	X						
Hygrohypnum micans	ENA; wna		X	MX	X							
Hygrohypnum molle	ENA; WNA				X							
Hypnum curvifolium	ENA											
Hypnum fertile	ENA				X	X						
Hypnum imponens	ENA; wna				X	X			X			AF
Hypnum pallescens	ena; WNA				X	X						AF
Isopterygiopsis muelleriana	ENA; wna	X	X	MX	X	X						
Isopterygium tenerum	ENA			MX; CA; SA						X		
Leucobryum albidum	ENA			MX; CA						X		
Leucobryum glaucum	ENA				X	X				X		

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Mosses												
Loeskeobryum brevirostre	ENA			MX; CA	X	X				X		
Mnium hornum	ENA				X	X						
Mnium thomsonii	ENA; WNA				X	X						
Neckera pennata	ENA; wna	X		SA	X	X						AU; NZ
Oncophorus rauii								X				
Oxystegus tenuirostris	ENA; WNA		X	MX; CA; nSA	X	X				X	X	AF
Philonotis fontana	NA			MX; sa	X	X						
Plagiomnium ciliare	ENA; wna		X									
Plagiothecium cavifolium	NA	X			X	X					X	
Plagiothecium denticulatum	NA			MX; CA; SA	X	X					X	AF
Plagiothecium laetum	NA				X	X						
Platyhypnidium riparioides	ENA; WNA			MX; CA; nSA	X	X				X		
Platylomella lescurii	ENA											
Polytrichum pallidisetum	ENA				X							

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Pseudotaxiphyllum distichaceum	ENA			CA		X						AU
Pseudotaxiphyllum elegans	NA	X			X	X			X		X	AF
Pylaisiadelpha tenuirostris	ENA											
Racomitrium aciculare	ENA; wna				X	X			X			AF
Rhizomnium appalachianum	ENA											
Rhizomnium punctatum	ENA; wna		X		X	X						AF
Schistidium rivulare var. *rivulare*	ENA; WNA			MX; CA; SA	X	X						AF; AU
Schwetschkeopsis fabronia	ENA					X						
Sematophyllum demissum	ENA				X	X						AF
Sematophyllum marylandicum	ENA											
Sphagnum flexuosum	ENA; wna	X		MX; nSA	X	X				X	X	AF
Sphagnum inundatum	ena				X							
Sphagnum palustre	ENA; WNA			MX; SA	X	X				X	X	AU; NZ
Taxiphyllum deplanatum	NA			MX								

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Mosses												
Tetraphis pellucida	na	X	X		X	X						
Thamnobryum alleghaniense	ENA					X						
Thuidium delicatulum	ENA; WNA		X	MX; CA; nSA	X	X				X		
Tortella humilis	ENA; wna		X	MX; CA; SA	X	X				X	X	AF
Ulota crispa	ENA			MX	X	X			X			AF
Weissia controversa	NA			MX; CA; nSA	X	X			X	X		AU; NZ
Hepatics												
Anastrophyllum michauxii	NA				X	X						
Anastrophyllum minutum	NA			MX	X	X			X			
Bazzania trilobata	ENA				X	X			X			
Blepharostoma trichophyllum	NA				X	X			X			
Calypogeia fissa	ENA				X							
Calypogeia muelleriana	ENA											
Calypogeia sullivantii	ENA											

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Hepatics												
Cephalozia bicuspidata	NA			MX;CA;SA	X	X			X			AF
Cephalozia connivens	NA				X	X			X			
Cephalozia lunulifolia	NA				X	X			X			
Cephaloziella byssacea	NA	X			X	X			X			
Chiloscyphus appalachianus								X				
Chiloscyphus cuspidatus	ENA; wna		X		X	X						
Chiloscyphus rivularis	NA				X							
Cololejunea biddlecomiae	ENA											
Conocephalum conicum	NA				X	X			X			AF
Diplophyllum apiculatum	ENA											
Drapanolejunea appalachiana							X					
Frullania asagrayana	ENA											
Frullania plana							X					
Harpalejunea ovata ssp. *integra*							X					

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Hepatics												
Harpanthus scutatus	ENA				X	X						
Herbertus aduncus ssp. *tenuis*							X					
Jamesoniella autumnalis	NA			MX	X	X					X	
Jubula pennsylvanica							X					
Jungermannia lanceolata	ENA; wna				X					X		
Kurzia sylvatica	ENA				X							
Lejunea laetevirens	sena			MX; CA; SA						X		
Lejunea lamacerina ssp. *geminata*							X					
Lejunea ruthii								X				
Lejunea ulicina ssp. *ulicina*	ENA				X					X		
Lepidozia reptans	ENA; WNA				X	X						
Leucolejunea clypeata	ENA											
Marsupella emarginata	NA				X	X			X			
Marsupella sphacelata	NA				X	X			X			

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Hepatics												
Metzgeria furcata	NA				X	X			X			AF
Metzgeria leptoneura	ena		X	MX; SA	X	X			X	X	X	AF; AU; NZ
Nardia lescurii							X					
Nowellia curvifolia	ENA			MX; CA	X	X			X		X	
Odontoschisma denudatum	ENA			CA; SA	X	X				X		
Odontoschisma prostratum	ENA									X		
Pallavacinia lyellii	ENA					X			X	X		AF
Pellia epiphylla	ENA; wna		X									
Plagiochila caduciloba								X				
Plagiochila europhyllon ssp. *echinata*								X				
Plagiochila porelloides	NA				X							
Plagiochila sullivantii								X				
Porella pinnata	ENA				X					X		
Porella platyphylloidea	NA				X							

Table 3. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Hepatics												
Radula obconica	ENA											
Radula sullivantii								X				
Radula tenax							X					
Riccardia multifida	ENA; wna		X		X				X			AF
Riccardia palmata	ENA; wna		X	MX	X	X			X	X		
Scapania nemorosa	ENA				X	X			X			
Scapania undulata	ENA; wna		X		X	X			X			AF
Solenostoma crenuliformis	ENA											
Solenostoma obscurum	ena											
Solenostoma pumilum	ENA; WNA				X	X			X			
Trichocolea tomentella	ENA				X	X						AF
Tritomaria exsecta	ENA; WNA			MX	X	X						
Tritomaria exsectiformis	ENA; wna				X	X						

Table 3. Continued.

Megaceros aenigmaticus	Hornwort	Taxon
		Wide Ranging: North America
		Northern Affinity
		Pacific Northwest Affinity
		Southern/Tropical Affinity
		European Affinity
		Asian Affinity
		Endemics: Appalachian
X		Endemics: Southern Appalachian
		Macaronesian Affinity
		Caribbean Affinity
		Polynesian Affinity
		Other

For the purpose of this analysis locales and affinities are defined as follows:

North America (NA) is the North American Continent and associated islands north of Mexico and is inclusive of Canada, USA (excluding Hawaii and US territories) and Greenland. Taxa exhibiting distribution within the Americas including those with Pacific Northwest, Southern/ Tropical and Caribbean affinities are shown in Table 4.

Eastern North America (ENA) is North America east of the Great Plains. Also included is Greenland.

sena indicates southeastern North America east of the Mississippi River and south of Kentucky and Virginia.

Western North America (WNA) is North America west of the Great Plains.

nwna indicates northwestern North America west of Montana and north of central California.

Mexico (MX) is the country of Mexico.

Central America (CA) is the Central American subcontinent consisting of Belize, Guatemala, El Salvador, Honduras, Nicaragua, Coast Rica and Panama.

South America (SA) is the South American continent and is inclusive of associated islands.

nSA indicates the northern-most parts of South America, including Columbia, Venezuela,Guyana, Suriname and French Guiana.

Appalachian Endemics are taxa found only in the area lying along the Appalachian mountain range stretching from Maine south to northern Georgia and Alabama. An example of an Appalachian Endemic is *Drapanolejunea appalachiana.*

Southern Appalachian Endemics are those taxa globally confined to the Southern Appalachian Mountain system which is comprised of the Blue Ridge Mountains and the Cumberland/Allegheny Plateau. An example of a Southern Appalachian Endemic is *Fissidens appalachensis,* as shown in Table 5.

Northern elements are taxa widely distributed over the northern hemisphere continents of North America, Europe and Asia. Also included as circumboreal/northern elements are taxa with widely disjunctive distributions as can be represented by: North American-European-Asian; Eastern North American/Appalachian-Asian; Eastern North American/Appalachian-European; and Eastern North American/Appalachian-Pacific Northwestern.

Table 4: Taxa exhibiting distribution within the Americas and taxa with distribution limited to Eastern North America.

Taxon	Wide Ranging: North America	Pacific Northwest Affinity	Southern/Tropical Affinity	Caribbean Affinity
General Americas Distribution				
Heterocladium macounii	sena; nwna	X	MX	
Isopterygium tenerum	ENA		MX; CA; SA	X
Lejunea laetevirens	sena		MX; CA; SA	X
Leucobryum albidum	ENA		MX; CA	X
Leucodon julaceus	ENA		MX	
Taxiphyllum deplanatum	NA		MX	
Eastern North American Distribution				
Calypogeia muelleriana	ENA			
Calypogeia sullivantii	ENA			
Cololejunea biddlecomiae	ENA			
Diplophyllum apiculatum	ENA			
Frullania asagrayana	ENA			
Hypnum curvifolium	ENA			
Leucolejunea clypeata	ENA			
Odontoschisma prostratum	ENA			X
Platylomella lescurii	ENA			
Pylaisiadelpha tenuirostris	ENA			
Radula obconica	ENA			
Rhizomnium appalachianum	ENA			
Sematophyllum marylandicum	ENA			
Solenostoma crenuliformis	ENA			

Table 5: Taxa exhibiting Appalachian and Southern Appalachian endemism.

Taxon	Endemics: Appalachian	Endemics: Southern Appalachian
Chiloscyphus appalachianus		X
Diphyscium cumberlandianum		X
Drapanolejunea appalachiana	X	
Fissidens appalachensis		X
Frullania plana	X	
Harpalejunea ovata ssp. *integra*	X	
Herbertus aduncus ssp. *tenuis*	X	
Jubula pennsylvanica	X	
Lejunea lamacerina ssp. *geminata*	X	
Lejunea ruthii		X
Megaceros aenigmaticus		X
Nardia lescurii	X	
Oncophorus rauii		X
Plagiochila caduciloba		X
Plagiochila europhyllon ssp. *echinata*		X
Plagiochila sullivantii		X
Porella wataugensis	X	
Radula sullivantii		X
Radula tenax	X	
Solenostoma obscurum	X	

Pacific Northwest is the area of North America including Alaska, Yukon, British Columbia, Washington, Oregon and the northern most part of California.

Europe is the European continent from Scandinavia south to the Mediterranean Sea and from the British Isles west to the Ural and Caucasus mountain ranges. Also included are Iceland and Macaronesia. Taxa exhibiting patterns of North American-European disjunction are shown in Table 6.

Macaronesia is the suite of islands to the southwest of Europe and includes the Azores, Canary Islands and Madeira.

Southern/Tropical is Mexico, Central America and South America. It is recognized however, that not all of the above areas are exclusively tropical.

Caribbean is comprised of all islands located within the Caribbean Sea and is inclusive of the Bahamas.

Asia is the Asian continent west of the Urals and Caucasus mountains and extends east through Japan. American-Asian disjunction patterns are exemplified by the taxa shown in Table 7. Taxa having American-European-Asian disjunction are shown in Table 8.

Polynesia is comprised of all islands within the Polynesian Sea, the South Pacific, the Philippines and Malaysia.

Other is comprised of all locales other then those previously defined and includes specifically: Africa (AF) including Madagascar, Australia (AU) including Tasmania and New Zealand (NZ) all of which are Southern Hemisphere localities.

Upper case letters indicate the primary and more widespread range of a taxon. Lower case letters indicate a restricted range of the taxon.

All distributional information for mosses was taken from Crum and Anderson (1981); Ireland (1982) and Sharp, Crum and Eckel (1994). Distributional information for hepatics was taken from Schuster (1966, 1969, 1974, 1980, 1992); and Hicks (1992).

Cosmopolitan elements (Table 9) have been variously defined. Crum and Anderson (1981) and Ireland (1982) define cosmopolitan as "occurring in all major floristic zones." Stearn (1992) defines cosmopolitan (*cosmopolitus*) as simply "world wide." Smith (1977) defines cosmopolitan as being "common to all or most of the world." Henderson, Henderson and Kenneth (1963) define cosmopolitan as "world-wide in distribution." Definitions of cosmopolitan in Webster (1991) include "having a world wide rather than limited or provincial scope or bearing"; "composed of ... elements from all or many parts of the world" and "found in most parts of the world and under varied ecological conditions". Sharp (1989) defines cosmopolitan elements as "those widely distributed over the Earth".

Table 6: Taxa exhibiting North American-European disjunction.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Caribbean Affinity
Andreaea rothii	ENA; wna	X	X		X	
Anomodon attenuatus	NA			MX; CA	X	X
Calypogeia fissa	ENA				X	
Chiloscyphus rivularis	NA				X	
Hygrohypnum micans	ENA; wna		X	MX	X	
Hygrohypnum molle	ENA; WNA				X	
Jungermannia lanceolata	ENA; wna				X	X
Kurzia sylvatica	ENA				X	
Lejunea ulicina ssp. *ulicina*	ENA				X	X
Plagiochila porelloides	NA				X	
Polytrichum pallidisetum	ENA				X	
Porella pinnata	ENA				X	X
Porella platyphylloidea	NA				X	
Sphagnum inundatum	ena				X	

Table 7: Taxa exhibiting American- Asian disjunction.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	Asian Affinity	Caribbean Affinity
Brotherella recurvans	ENA	X			X	
Climacium americanum	ENA: wna		X		X	
Schwetschkeopsis fabronia	ENA				X	
Taxiphyllum taxirameum	ENA; wna			CA; SA	X	X
Thamnobryum alleghaniense	ENA				X	

Table 8: Taxa exhibiting American-European-Asian disjunction

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Macaronesian Affinity	Caribbean Affinity
Anastrophyllum michauxii	NA				X	X		
Anastrophyllum minutum	NA			MX	X	X	X	
Anomodon rostratus	NA			MX; CA	X	X		X
Anomodon rugellii	ENA				X	X		
Bazzania trilobata	ENA				X	X	X	
Blepharostoma trichophyllum	NA				X	X	X	
Bryhnia novae-angliae	ENA; wna	X	X		X	X		
Cephalozia connivens	NA				X	X	X	
Cephalozia lunulifolia	NA				X	X	X	
Cephalozia macounii	NA				X	X		
Cephaloziella byssacea	NA	X			X	X	X	
Chiloscyphus cuspidatus	ENA; wna		X		X	X		
Ctenidium malacodes	NA		X	MX; SA	X	X	X	X
Dicranum fulvum	ENA				X	X		
Dicranum viride	ENA				X	X		
Eurhynchium hians	ENA; wna			MX	X	X		X
Fontinalis dalecarlica	ENA; wna	X			X	X		
Harpanthus scutatus	ENA				X	X		
Heterophyllium affine	sena			MX; CA; sa	X	X		X
Hygrohypnum eugyrium	ENA				X	X		
Hygrohypnum luridum	ENA; WNA	X	X		X	X		
Hypnum fertile	ENA				X	X		
Isopterygiopsis muelleriana	ENA; wna	X	X	MX	X	X		
Lepidozia reptans	ENA; WNA				X	X		
Loeskeobryum brevirostre	ENA			MX; CA	X	X		X
Marsupella emarginata	NA				X	X	X	
Marsupella sphacelata	NA				X	X	X	

Table 8. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Macaronesian Affinity	Caribbean Affinity
Mnium hornum	EAN				X	X		
Mnium thomsonii	ENA; WNA				X	X		
Odontoschisma denudatum	ENA			CA; SA	X	X		X
Philonotis fontana	NA			MX; sa	X	X		
Plagiothecium laetum	NA				X	X		
Platyhypnidium riparioides	ENA; WNA			MX; CA; nSA	X	X		X
Riccardia palmata	ENA; wna		X	MX	X	X	X	X
Solenostoma pumilum	ENA; WNA				X	X	X	
Tetraphis pellucida	na	X	X		X	X		
Thuidium delicatulum	ENA; WNA		X	MX; CA; nSA	X	X		X
Tritomaria exsecta	ENA; WNA			MX	X	X		
Tritomaria exsectiformis	ENA; wna				X	X		

Table 9: Taxa exhibiting cosmopolitan distribution.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Atrichum undulatum	NA			MX; CA	X	X						AF
Bartramia pomiformis	ENA; wna		X	SA	X	X						AU
Blindia acuta	ENA; wna	X	X	CA; SA	X	X			X			AF; AU
Brachythecium plumosum	NA			MX; CA; nSA	X	X				X	X	NZ
Brachythecium rivulare	NA	X			X	X			X			AF; AU
Brachythecium rutabulum	NA			CA; SA	X	X					X	AF;AU; NZ
Brachythecium salebrosum	NA			MX	X	X						AU; NZ
Cephalozia bicuspidata	NA			MX;CA;SA	X	X			X			AF
Chiloscyphus rivularis	NA	X			X	X			X			AF
Conocephalum conicum	NA				X	X			X			AF
Cratoneuron filicinum	NA	X		MX; ca; SA	X	X						AU; NZ
Dicranella heteromalla	ENA; WNA		X	CA; nSA	X	X						AF
Dicranum scoparium	NA	X	X	MX; CA; SA	X	X			X			AF; AU; NZ
Fissidens bryoides	NA			MX; CA; SA	X	X				X		AF

Table 9. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Fissidens dubius	ENA; wna			MX	X	X			X	X		AF
Hypnum imponens	ENA; wna				X	X			X			AF
Hypnum pallescens	ena; WNA				X	X						AF
Leucobryum glaucum	ENA				X	X				X		AF
Metzgeria conjugata	NA				X	X						AF; NZ
Metzgeria furcata	NA				X	X			X			AF
Metzgeria leptoneura	ena		X	MX; SA	X	X			X	X	X	AF; AU; NZ
Neckera pennata	ENA; wna	X		SA	X	X						AU; NZ
Oxystegus tenuirostris	ENA; WNA		X	MX; CA; nSA	X	X				X	X	AF
Plagiothecium denticulatum	NA			MX; CA; SA	X	X					X	AF
Pseudotaxiphyllum elegans	NA	X			X	X			X		X	AF
Racomitrium aciculare	ENA; wna				X	X			X			AF
Rhizomnium punctatum	ENA; wna		X		X	X						AF
Scapania undulata	ENA; wna		X		X	X			X			AF
Schistidium rivulare var. *rivulare*	ENA; WNA			MX; CA; SA	X	X						AF; AU

Table 9. Continued.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Endemics: Appalachian	Endemics: Southern Appalachian	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Sematophyllum demissum	ENA				X	X						AF
Sphagnum flexuosum	ENA; wna	X		MX; nSA	X	X				X	X	AF
Sphagnum palustre	ENA; WNA			MX; SA	X	X				X	X	AU; NZ
Tortella humilis	ENA; wna		X	MX; CA; SA	X	X				X	X	AF
Trichocolea tomentella	ENA				X	X						AF
Ulota crispa	ENA			MX	X	X			X			AF
Weissia controversa	NA			MX; CA; nSA	X	X			X	X		AU; NZ

Cosmopolitan as used here, denotes the presence of taxa, which are reasonably wide spread globally, across the northern hemisphere continents of North America, Europe and Asia; occurring additionally in localities of the southern hemisphere. Thus, to be circumscribed as cosmopolitan a taxon must occur on at least four (4) continents, one of which must be in the southern hemisphere. And, may include in addition, outliers from island groups, smaller subcontinents, or what might also be interpreted as disjunct. Examples shown in Table 9 include: *Atrichum undulatum* which occurs in North America, Mexico,Central America, Europe, Asia and Africa; *Bartramia pomiformis* which occurs in Eastern and Western North America, South America, Europe, Asia and Australia; *Blindia acuta* which occurs in Eastern and Western North America, Central America, South America, Europe, Asia, Macaronesia, Africa and Australia; *Brachythecium plumosum* which occurs in North America, Mexico, South America, Europe, Asia, the Caribbean, Polynesia and New Zealand; *Brachythecium rivulare* which occurs in North America, Europe, Asia, Macaronesia, Africa and Australia; *Brachythecium rutabulum* which occurs in North America, Central America, South America, Europe, Asia, Polynesia, Africa, Australia and New Zealand; *Brachythecium salebrosum* which occurs in North America, Mexico, Europe, Australia and New Zealand; *Cephalozia bicuspidata* which occurs in North America, Mexico, Central America, South America, Europe, Asia, Macaronesia and Africa.

Taxa that are globally wide spread, shown in Table 10, have been separated into that category because they lack only one of the components necessary to place them into the cosmopolitan category. For example: *Hookeria acutifolia* and *Pallavacinia lyellii* lack European distribution; *Riccardia multifida* lacks Asian distribution and *Scapania nemorosa* exhibits no Southern Hemispheric distribution.

Disjunction of elements has been variously defined. Stearn (1992) defines disjunct (*disjunctus*) as "separate, distinct". Jackson (1928) defines disjunctive (*disjunctivus*) as "disjoined". Webster (1991) defines disjunct as being "marked by separation of or from usually contiguous parts or individuals"; "discontinuous"; "any of the alternatives that makeup a logical disjunction". Disjunction as defined by Webster (1991) is a "sharp cleavage; disunion; separation". Webster (1991) defines disjunctive as "marked by breaks or disunity". Henderson, Henderson and Kenneth (1963) define disjunction as "geographical distribution in discontinuous areas".

As used here disjunction refers to the separation of reasonably wide spread taxa by an ocean, some landmass or a large portion thereof. For example a taxon, such as *Schwetschkeopsis fabronia*, occurring only in Eastern North America and no where else except Asia is a disjunct population (Table 11). In this case the disjunction is a result of the non-occurrence across Western North America and the Pacific Ocean. Alternatively this could be viewed as disjunction due to non-occurrence across the Atlantic Ocean and Europe. *Plagiomnium ciliare* exemplifies North American disjunction, occurring in Eastern North America and occurring no where else except the Pacific Northwest.

Table 10: Taxa having globally wide spread distribution.

Taxon	Wide Ranging: North America	Northern Affinity	Pacific Northwest Affinity	Southern/Tropical Affinity	European Affinity	Asian Affinity	Macaronesian Affinity	Caribbean Affinity	Polynesian Affinity	Other
Dicranodontium denudatum	ENA; wna		X	CA	X	X			X	
Haplohymenium triste	ENA			MX; CA; SA	X	X			X	
Hookeria acutifolia	ENA; wna		X	MX; CA; nSA		X		X	X	
Jamesoniella autumnalis	NA			MX	X	X			X	
Nowellia curvifolia	ENA			MX; CA	X	X	X		X	
Pallavacinia lyellii	ENA					X	X	X		AF
Plagiothecium cavifolium	NA	X			X	X			X	
Riccardia multifida	ENA; wna		X		X		X			AF
Scapania nemorosa	ENA				X	X	X			

Table 11: Taxa exhibiting North American disjunction and one taxon with an unusual disjunction pattern.

Taxon	Wide Ranging: North America	Pacific Northwest Affinity	Southern/Tropical Affinity	Asian Affinity	Other
Pellia epiphylla	ENA; wna	X			
Plagiomnium ciliare	ENA; wna	X			
Pseudotaxiphyllum distichaceum	ENA		CA	X	AU

Pellia epiphylla and *Plagiomnium ciliare* both exhibit a pattern of bryogeographic disjunction with a wider distributional pattern in Eastern North America than in the American Pacific Northwest, as shown in Table 11. An unusual, and within this flora, unique, distributional pattern is exhibited by *Pseudotaxiphyllum distichaceum* which appears disjunctly in Eastern North America, Central America, Australia and Asia. This bryogeographic distributional pattern is unlike that of any other bryophyte collected at Falls Branch Falls.

Within Table 3 (p. 26) various categories may be formed. The Northern Affinity category includes all Falls Branch bryoflora having northern and/or Pacific Northwestern affinity.

Of 76 taxa shown in Table 2 (p. 24) the majority, 45, are cosmopolitan or globally widespread. Thirty six are cosmopolitan taxa and nine (9) are globally widespread taxa. Northern and Endemic taxa total 36 with 16 of the taxa exhibiting Northern affinity and 20 of the taxa exhibiting Appalachian endemism. Of the endemic taxa, half are broadly endemic to the Appalachians and half are Endemic to the Southern Appalachians, a few of them being narrowly endemic. Fourteen (14) are European American disjunct taxa, 39 are American-European-Asian disjunct taxa. Thirty (30) taxa exhibit Caribbean affinity. Five (5) taxa exhibit North American-Asian disjunction. The occurrence of Asian disjunct taxa was to be expected as indicated by Iwatsuki (1958).

Bryoflora having Northern Affinity

Mosses	Hepatics
Andreaea rothii	*Anastrophyllum minutum*
Brachythecium rivulare	*Blepharostoma trichophyllum*
Brotherella recurvans	*Cephaloziella byssacea*
Bryhnia novae-angliae	*Chiloscyphus rivularis*
Climacium americanum	*Harpanthus scutatus*
Fontinalis dalecarlica	*Lepidozia reptans*
Hygrohypnum luridum	*Tritomaria exsecta*
Plagiomnium ciliare	
Tetraphis pellucida	

The Caribbean affinity category includes Falls Branch bryophytes also found in the Caribbean.

Bryoflora having Caribbean Affinity

Mosses	Hepatics
Anomodon attenuatus	*Jungermannia lanceolata*
Anomodon rostratus	*Lejunea laetevirens*
Brachythecium plumosum	*Lejunea ulicina*
Cratoneuron filicinum	*Metzgeria leptoneura*
Eurhynchium hians	*Odontoschisma denudatum*
Fissidens bryoides	*Odontoschisma prostratum*

Fissidens dubious
Heterophyllium affine
Hookeria acutifolia
Isopterygium tenerum
Leucobryum albidum
Leucobryum glaucum
Loeskeobryum brevirostre
Oxystegus tenuirostris
Platyhypnidium riparioides
Sphagnum flexuosum
Sphagnum palustre
Taxiphyllum taxirameum
Thuidium delicatulum
Tortella humilis
Weissia controversa

Pallavacinia lyelli
Porella pinnata
Riccardia palmata

Bryoflora having Southern Appalachian Endemism

Mosses
Diphyscium cumberlandianum
Fissidens appalachensis
Oncophorus rauii

Anthocerophyte
Megaceros aenigmaticus

Hepatics
Chiloscyphus appalachianus
Lejunea ruthii
Plagiochila caduciloba
Plagiochila europhyllon ssp. *echinata*
Plagiochila sullivantii
Radula sullivantii

The 10 taxa endemic to the Southern Appalachians represent 13.33% of the approximately 75 endemic taxa estimated to be present by Billings and Anderson (1966).

CHAPTER VIII
COMMUNITY ANALYSES AND STRUCTURES

Background and Perspectives

Various kinds of assessment methods have been developed to analyze and delineate community structures of both plant and animal systems. Kent and Coker (1994) is one of the more recent, comprehensive texts that reviews and explains methods for descriptive vegetation analysis.

The application of vegetation analysis for cryptogamic (small, spore-bearing) plants has only received minor attention and study relative to the number and scales of landscapes and macro-vegetation (large, obvious, seed-bearing plants). The fundamental problem with small plants is their diminutive scale and uneven distribution. However there have been a number of studies over the past decades that have attempted to measure and classify cryptogamic species communities and associations (Barkman, 1958). An excellent review of some early studies is presented by Huntzinger (1985) and more recently by Dierßen (2001).

Strict or highly constrained ecological investigations often follow a protocol of uniformly sized sample plots at a scale proportionate to the sample objects. For instance, in forest or grassland community analysis, the place of sampling is dictated by the presence of (presumably a uniform) a discernable target community. The plot size, number of plots, and location of plots is designed according to the area under consideration and the stature of the vegetation to be sampled.

Bryophyte communities (or associations) represent miniature groups of species within more conspicuous macro-vegetational units. They may occur as relatively pure populations and are often collected as a single taxon sample. More often, however, bryophytes occur commingled as mixtures of few, several, or many taxa, and such gatherings rarely receive attention to "what is growing with what."

An often prescribed, traditional method of vegetation sampling usually employs a rather strict sample-plot design, randomized to minimize sample bias. In the case of bryophytes, this approach may be appropriate for one-dimensional vegetation such as peat lands or tundra. But, it is nearly a hopeless approach for multi-dimensional vegetation such as in forested landscapes, within which the occurrence of bryophytes is uneven.

Inherent to the challenge of community analysis of small plants is illustrated by Zartman and Pittillo (1998) whose examination of spray cliff communities in the southern Appalachians is currently the only reference to be found attempting quantitative vegetation analysis in spray zones. They attribute the absence of quantitative study information on the vegetation of spray cliff areas to their "rarity, restricted geographic range and anomalous character." Such could be said for many other examples of highly

specialized or restricted, micro-landscape features or substrates where cryptogams occur within the larger context of the landscape. In most cases, cryptogamic studies have required adapting or developing a strategy for data collection following certain criteria of sampling design that are reasonable and appropriate to the site(s) under investigation.

Analyses

Several approaches and analytical techniques were applied to the specimen data set to organize and search for species relationships (associated taxa) and environmental factors (moisture, light, and substrate) that corresponded to dominant species assemblages. The analytical techniques explored, included: SPSS TwoStep Cluster Number Crosstabulation (University of Tennessee, Statistical Consulting Center); and several programs of the Pisces, Community Analysis Package (Pisces Conservation LTD, 2002). Within the Pisces Package, the CAP programs of Reciprocal Averaging and TWINSPAN were used to search for structure within the ecological and species community data.

SPSS TwoStep Cluster Number Crosstabulation

A descriptive, direct comparison of taxa occurring under conditions of environmental factors was used to construct a dendrogram of: 1) communities, 2) societies, and 3) facies; following the hierarchical scheme and nomenclature applied by Cain and Sharp (1938).

An Access database of 1655 records comprising 145 taxa was sorted for combinations of environmental factors (moisture, light, substrate) using the SPSS Two-Step Crosstabulation. Eleven clusters were extracted from the 16 possible combinations of factors. Substrate was divided into "Rock" (R) and "Not Rock" (N). Moisture level was divided into "Aquatic" (A), "Wet-Moist" (W) and "Damp to Dry" (D). Light intensity was divided into "Sun" (H); "Reflected; Filtered or Shade" (S) and "Deep Shade to Dark" (D). The 11 clusters were named using the initials of the above designations. The clusters extracted are shown in Table 12.

A second sorting analysis of the same environmental factors was performed with the SPSS Two-Step Crosstabulation using a smaller subset of the database. The subset database consisted of records containing only those taxa occurring 25 or more times. This constraint reduced the working data set to 804 records containing the 15 most frequently occurring (dominant) taxa (Table 13).

The results from the two SPSS crosstabulations, exhibited similar levels of precision using either the entire data set or the data set comprised of only taxa occurring 25 or more times. Both analyses yielded the same 11 environmental clusters. This suggests that application of the sample technique of this study to future studies requires that only the most common taxa and their associated ecological data be used in the analysis. The results as arranged in the dendrogram (Figure 4, page 59) would apply equally to either

Table 12: Cluster numbers, abbreviations and names used in SPSS analysis.

Cluster Number	Cluster Abbreviation	Cluster Name
1	NWS	Non-rock, wet, shady
2	NMH*	Non-rock, moist, sunny
3	RAS	Rock, aquatic, shady
4	RAH	Rock, aquatic, sunny
5	RWS	Rock, wet, shady
6	RWD	Rock, wet, dark
7	RWH	Rock, wet, sunny
8	RDD	Rock, damp, dark
9	RDH	Rock, damp, sunny
10	RDS	Rock, damp, shady
11	NDS	Non-rock, damp, shady

*Cluster 2 was equally split between W and D, thus it was given an intermediate moisture designation of M ("Moist").

Table 13: Frequency and relative frequency of taxa recorded 25 or more times.

Taxa	Frequency	Relative Frequency
Atrichum undulatum	38	4.7
Blindia acuta	25	3.1
Hygrohypnum eugyrium	29	3.6
Jubula pennsylvanica	133	16.5
Mnium hornum	48	6.0
Philonotis fontana	26	3.2
Plagiochila porelloides	129	16.0
Platyhypnidium riparioides	29	3.6
Platylomella lescurii	46	5.7
Porella pinnata	35	4.4
Rhizomnium punctatum	51	6.3
Scapania nemorosa	80	10.0
Scapania undulata	26	3.2
Schistidium rivulare	32	4.0
Thuidium delicatulum	77	9.6
Total	804	100

the entire data of 1655 records or the subset of 804 records.

The distribution of combinations of environmental factors into the 11 clusters was: three (3) Non-rock (N), and eight (8) Rock (R). Two (2) clusters were Aquatic (A), four (4) were Wet (W), one (1) was Moist (M) and four (4) were Damp to Dry (D). Four (4) clusters were sunny (H), five (5) were Shady (S) and two (2) were Dark (D). Table 14 reports the distribution of the 15 most dominant taxa among the 11 clusters.

Table 15 arranges the assemblages of the most dominant bryophytes in each cluster as determined by SPSS TwoStep cluster analysis. Assemblages are based on the three or four most frequently occurring taxa within each ecological cluster. The taxa are listed in order of their frequency within each cluster from most to least frequent. The assemblages shown in Table 15 are named beginning with the most frequently found taxon within that cluster. When two or more bryophytes were equally dominant in a cluster they are recorded in alphabetical order. The only taxon found occurring in all eleven clusters, as shown in Table 14 was *Plagiochila porelloides*.

The eleven clusters in Table 15 are arranged in the dendrogram (Figure 4) to construct the structure of communities, societies, and facies.

The hierarchy adopted for the grouping and naming taxa assemblages within clusters is similar to that used by Cain and Sharp (1938) to delineate the relationships of bryophyte communities in the Great Smoky Mountains. Figure 4 reflects the hierarchical components of the communities, societies, and facies based on the dominant, common taxa. Within the 11 clusters, two (2) bryophyte communities are formed. The communities are delineated naturally according to substrate composition. Each level of associated taxa below community level is aligned along gradients of moisture and insolation.

The first community is the *Thuidium delicatulum-Mnium hornum* community composed of clusters NWS; NMH and NDS all of which occur on non-rock substrates. Within the *Mnium hornum-Thuidium delicatulum* community there are two bryophyte societies. The first is the *Thuidium-Mnium* society composed of only cluster NWS. The second is the *Thuidium-Atrichum* society composed of clusters NMH and NDS. The primary environmental factor separating these societies is the moisture level. The *Thuidium-Mnium* society has a wet moisture level and the *Thuidium-Atrichum* society has a damp to moist moisture level.

The second community is the *Jubula pennsylvanica-Plagiochila porelloides* community composed of clusters RAS; RAH; RWS; RWD; RWH; RDD; RDH and RDS all of which occur on rock substrates. Within the *Jubula pennsylvanica-Plagiochila porelloides* community there are two societies.

The two societies are separated by aquatic or non-aquatic habitat. The first society is the aquatic *Platylomella* society composed of clusters RAS and RAH. Two facies were

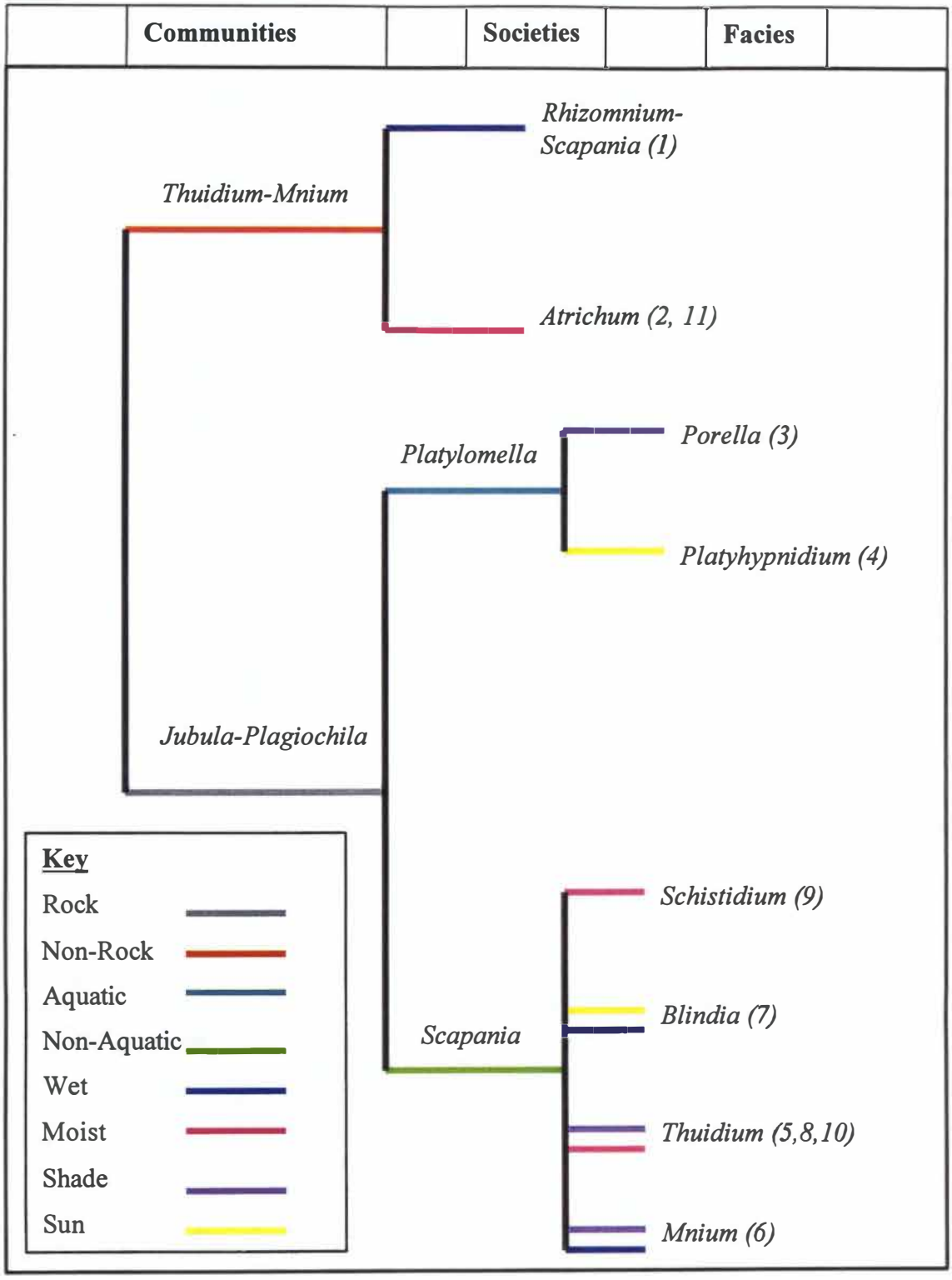
Table 14: Occurrence and frequency of taxa recorded 25 times or more as separated by cluster.

Taxa	NWS	NMH	RAS	RAH	RWS	RWD	RWH	RDD	RDH	RDS	NDS
Atrichum undulatum	3	3	2	0	11	1	2	2	2	7	5
Blindia acuta	0	0	2	0	5	3	11	1	2	1	0
Hygrohypnum eugyrium	1	0	2	0	12	1	5	0	3	4	1
Jubula pennsylvanica	2	0	15	8	68	8	9	10	4	8	1
Mnium hornum	5	5	3	0	13	5	2	5	0	8	2
Philonotis fontana	0	2	3	1	7	0	8	2	1	2	0
Plagiochila porelloides	3	2	19	3	57	5	18	6	7	8	1
Platyhypnidium riparioides	0	0	7	4	9	3	0	0	1	4	1
Platylomella lescurii	1	2	21	3	14	0	3	0	0	2	0
Porella pinnata	0	1	19	1	11	0	1	1	1	0	0
Rhizomnium punctatum	4	1	3	0	25	4	4	3	2	5	0
Scapania nemorosa	4	2	5	2	27	3	14	5	4	14	0
Scapania undulata	0	2	4	2	11	0	2	0	3	2	0
Schistidium rivulare	0	0	0	0	8	3	1	1	4	13	2
Thuidium delicatulum	11	5	2	0	31	3	3	7	2	8	5
Total	34	25	107	24	309	39	83	43	36	86	18

Table 15: Taxa assembled by dominance within each cluster arranged from most to least frequently recorded. Numbers in parentheses indicate number of times taxon was recorded.

NWS	NMH	RAS	RAH
Thuidium delicatulum (11)	*Mnium hornum* (5) *Thuidium delicatulum* (5)	*Platylomella lescurii* (21)	*Jubula pennsylvanica* (8)
Mnium hornum (5)	*Atrichum undulatum* (3)	*Plagiochila porelloides* (19) *Porella pinnata* (19)	*Platyhypnidium riparioides* (4)
Rhizomnium punctatum(4) *Scapania nemorosa*(4)		*Jubula pennsylvanica* (15)	*Plagiochila porelloides*(3) *Platylomella lescurii* (3)
RWS	**RWD**	**RWH**	**RDD**
Jubula pennsylvanica (68)	*Jubula pennsylvanica* (8)	*Plagiochila porelloides* (18)	*Jubula pennsylvanica* (10)
Plagiochila porelloides (57)	*Mnium hornum* (5) *Plagiochila porelloides* (5)	*Scapania nemorosa* (14)	*Thuidium delicatulum* (7)
Thuidium delicatulum (31)	*Rhizomnium punctatum* (4)	*Blindia acuta* (11)	*Plagiochila porelloides* (6)
Scapania nemorosa (27)		*Jubula pennsylvanica* (9)	*Mnium hornum* (5) *Scapania nemorosa* (5)
RDH	**RDS**	**NDS**	
Plagiochila porelloides (7)	*Scapania nemorosa* (14)	*Atrichum undulatum* (5) *Thuidium delicatulum* (5)	
Jubula pennsylvanica(4) *Scapania nemorosa* (4) *Schistidium rivulare* (4)	*Schistisium rivulare* (13)	*Mnium hornum* (2) *Schistisium rivulare* (2)	
	Jubula pennsylvanica (8) *Mnium hornum* (8) *Plagiochila porelloides* (8) *Thuidium delicatulum* (8)		

Figure 4: Communities, societies and facies of environmental clusters.



extracted from the *Platylomella* society. The *Porella* facie was extracted from the *Platylomella* society and is characterized by the presence of shade. The second society is the non-aquatic *Scapania* society composed of clusters RWS; RWD; RWH; RDD; RDH and RDS. Within the *Scapania* society four facies were extracted. The first, the *Schistidium* facie, composed of cluster RDH having a shady and moist habitat. The second was the *Blindia* facie composed of cluster RWH having a sunny and wet habitat. The third was the *Thuidium* facie composed of clusters RWS; RDD and RDS having a shady and less moist habitat. The fourth is the *Mnium* facie composed of cluster RWD and having a shady and very wet habitat.

A comparison of the distribution of the 145 taxa among the 11 clusters is presented in Table 16. The cluster containing the highest percentage of the total taxa was RWS which contained 73.8%. The cluster with the second highest percentage of the total taxa was RDS which contained 46.2% of the total taxa. The two clusters containing the least percentage of the total taxa were clusters RAH and RWD which contained 18.6% and 26.9% respectively. Three of the clusters contained less then 30% of the total taxa. The other eight of the clusters contained more then 30% of the total taxa. Of the six clusters containing more then 35% of the total taxa four of them were located in the shade, one in very deep shade and one in sun. One cluster was aquatic, three were wet and two were damp; all six occurred on rock substrates. Of the three clusters containing less than 30% of the total taxa; two were located in the sun and one in very deep shade. One of the clusters was moist, one wet and one aquatic. Two of the clusters occurred on rock substrates and one on a non-rock substrate. There were only three non-rock clusters in the entire set.

Among the 145 total taxa are a number of which are infrequent or rare within the study site. Thirty-four of these also may be regarded as "Special Interest Taxa" because they represent taxa of notable status due to genuine rarity throughout their range, threatened and endangered status, or exceptional distributional ranges. Table 17 lists and reports the occurrence and distribution of "Special Interest Taxa" present in each of the 11 clusters. Each occurrence is designated for status as: Rare, Threatened, Sensitive, Endangered, Tropical, Boreal and/or Endemic.

As reported in Table 17 greater then 25% of the special interest taxa occur at least once in seven of the eleven clusters. Only one cluster, RWS, contained over half of all special interest taxa. The least number of special interest taxa were found in cluster RAH which contained just over one-third of taxa that were found in RWS.

Eleven of the 34 special interest taxa exhibited exclusive association with single clusters. The taxon associating exclusively with the *Thuidium delicatulum, Mnium hornum* and *Rhizomnium punctatum/Scapania nemorosa* cluster, NWS, is *Sphagnum flexuosum.* Taxa associating exclusively with the *Jubula pennsylvanica, Plagiochila porelloides, Thuidium delicatulum* and *Scapania nemorosa* cluster, RWS, include *Brachythecium rutabulum, Cratoneuron filicinum, Diphyscium cumberlandianum, Hygrohypnum micans, Plagiochila sullivantii, Porella wataugensis* and *Tritomaria*

Table 16: Number and percentage of total taxa found in each cluster, based on 145 total taxa recorded.

Cluster	Number of Taxa	Percentage of Total Taxa
NWS	52	35.9
NMH	43	29.7
RAS	64	44.1
RAH	27	18.6
RWS	107	73.8
RWD	39	26.9
RWH	54	37.2
RDD	56	38.6
RDH	47	32.4
RDS	67	46.2
NDS	45	31.0

Table 17: Taxa of special interest present in each cluster (Rare, Threatened, Sensitive, Endangered, Tropical, Boreal and/or Endemic). *Taxa that were not included in the statistical analysis due to incomplete environmental data.

Taxa	**NWS**	**NMH**	**RAS**	**RAH**	**RWS**	**RWD**	**RWH**	**RDD**	**RDH**	**RDS**	**NDS**
Mosses											
*Anomodon rugellii**											
Blindia acuta			X		X	X	X	X	X	X	
Brachythecium rutabulum					X						
Cratoneuron filicinum					X						
Diphyscium cumberlandianum					X						
Fissidens appalachensis			X	X	X			X			
Heterocladium macounii					X	X		X			
Hookeria acutifolia	X	X			X	X		X			
Hygrohypnum luridum										X	
Hygrohypnum micans					X						
Hygrohypnum molle			X	X							
*Neckera pennata**											
Oncophorus rauii									X	X	
Rhizomnium appalachianum	X		X	X	X	X	X	X	X		
Sphagnum flexuosum	X										
Hepatics											
Anastrophyllum minutum							X	X	X		
Blepharostoma trichophyllum	X		X		X		X	X		X	
Chiloscyphus appalachianus	X		X		X			X			
Drepanolejunea appalachiana		X	X								X
Frullania plana	X		X	X	X						
Harpanthus scutatus			X		X						
Herbertus aduncus ssp. *tenuis*	X						X		X	X	

Table 17. Continued.

Taxa	NWS	NMH	RAS	RAH	RWS	RWD	RWH	RDD	RDH	RDS	NDS
Lejunea laetevirens								X			X
Lejunea ruthii									X		
Marsupella sphacelata									X		
Nardia lescurii				X			X				
Plagiochila caduciloba							X				
Plagiochila europhyllon ssp. *echinata*					X			X			
Plagiochila sullivantii					X						
Porella wataugensis					X						
Radula sullivantii					X					X	
Radula tenax		X	X		X		X	X	X		X
Tritomaria exsectiformis					X						
Hornwort											
Megaceros aenigmaticus			X	X					X		
Total	7	3	11	6	19	4	8	11	9	6	3

Note: The above information was derived from Crum and Anderson (1981); Schuster (1966, 1969, 1974, 1980, 1992); Amoroso (1997) and Natural Heritage websites: www.state.tn.us/environment/nh/nonvasc.html; www.dnr.state.ga.us/dnr/wild/natural/sppl t.htm; ftp.abi.org/pub/nhp/us/nc/plants.txt; http://www.kynaturepreserves.org; http://www.dcr.state.va.us/dnh.

exsectiformis. The taxon associating exclusively with the *Plagiochila porelloides, Scapania nemorosa, Blindia acuta* and *Philonotis fontana* cluster, RWH, is *Plagiochila caduciloba.* The taxa associating exclusively with the *Plagiochila porelloides* and *Jubula pennsylvanica/ Scapania nemorosa/Schistidium rivulare* cluster, RDH, are *Lejunea ruthii* and *Marsupella sphacelata.* The taxon associating exclusively with the *Scapania nemorosa, Schistidium rivulare* and *Jubula pennsylvanica/Mnium hornum/Thuidium delicatulum* cluster, RDS is *Hygrohypnum luridum.* No taxon associated exclusively with the *Platylomella lescurii, Plagiochila porelloides, Porella pinnata* and *Jubula pennsylvanica* cluster, RAS, or with the *Jubula pennsylvanica, Thuidium delicatulum, Plagiochila porelloides* and *Mnium hornum/Scapania nemorosa* cluster, RDD. See Table 17. Two of the special interest taxa, *Anomodon rugellii* and *Neckera pennata* recorded from the study site did not have appropriate environmental data to be assigned to any of the 11 clusters. Other taxa not having appropriate environmental data to be assigned to any of the 11 clusters were: *Andreaea rothii, Bartramia pomiformis, Heterophyllum affine, Lejunea ulicina, Pallavacinia lyellii, Porella platyphylloidea, Schwetschkeopsis fabronia* and *Ulota crispa.*

Seven (7) of the 34 special interest taxa form associations with unique combinations of two clusters. *Harpanthus scutatus* associates with clusters RAS and RWS. *Hygrohypnum molle* associates with clusters RAS and RAH. *Lejunea laetevirens* associates with clusters RDD and NDS. *Nardia lescurii* associates with clusters RAH and RWH. *Oncopharous rauii* associates with clusters RDH and RDS. *Plagiochila europhyllon* ssp. *echinata* associates with clusters RWS and RDD. *Radula sullivantii* associates with clusters RWS and RDS.

Four (4) of the 34 special interest taxa form associations with unique combinations of three naturally formed clusters. *Anastrophyllum minutum* associated with clusters RWH, RDD and RHD. *Drepanolejunea appalachiana* associated with clusters NMH(2), RAS and NDS. *Heterocladium macounii* associated with clusters RWS, RWD and RDD. *Megaceros aenigmaticus* associated with clusters RAS, RAH and RDH. The taxa associating with the most different clusters were *Rhizomnium appalachianum* (8 clusters), *Blindia acuta* and *Radula tenax* (7 clusters each) and *Blepharostoma trichophyllum* (6 clusters).

Pisces, Community Analysis Package

Several preliminary analyses explored the utility of the comprehensive Pisces Conservation, LTD, Community Analysis Package (2002 version 1.5). Several multivariate views of the data sets were examined using Principal Components Analysis (PCA), Detrended Correspondence Analysis (DECORANA), Two Way Indicator Species Analysis (TWINSPAN), Agglomerative Cluster Analysis, and Divisive Cluster Analysis. Among these analytical techniques the most informative and interpretable results were yielded by the Two Way Indicator Species Analysis (TWINSPAN), and Principal Components Analysis PCA.

Initially the data were converted into taxon presence and absence values forming a new, smaller data set for operating in the Pisces programming. Presence-Absence data scored as binary values of 1 or 0 (zero) are acceptable in the data matrices for these analyses, but must be submitted to the programs as Excel Spreadsheets converted to CSV (comma delimited data) files for Pisces to analyze the data.

Preliminary views of the entire data matrix of 1655 records in the Pisces environment proved too complex for any meaningful interpretation, due to the large number of 0 (zero) values in the data matrix. When selecting a down weighting of low frequency taxa, and removing all categorical ecological data, the results remained too complicated to discern trends of taxa associations.

A second analysis strategy reorganized taxa occurrence records into a number of discrete databases divided between Rock and Non-Rock substrates. Further divisions of the databases included, for Non-Rock substrates: Trees, Logs, Humus, and Soil. Among the Rock substrates the data were divided into microtopographic zones of: East Bank, Center Stream, and West Bank.

In each of the above data sets presence/absence values were replaced with dominance values for all taxa occurring in each substrate or zonal category. The cumulative dominance values (sums) were calculated for each taxon and the data table sorted for most dominant to least dominant. The dominance values for each taxon (considered an Importance Value of Relative Dominance) were transferred into Excel Spreadsheets and then trimmed to only most dominant taxa for analysis. The trimmed spreadsheets were then saved as CSV files (comma delimited format) for analysis by the Pisces, Community Analysis Package.

Examples of CSV files and associated analyses are presented and discussed below. The first example discussed (comparison of Rock and Non-Rock substrates) describes the order of data manipulations used to construct the CSV files from the original raw data. All CSV files used in the analyses were constructed using the same steps to standardize the data.

One thousand, six hundred and sixty-four (1664) taxa occurrence records were used in the analysis comparing Rock and Non-Rock substrates. Rock records accounted for 1301 taxa occurrences and Non-Rock taxa occurrences totaled 363. Table 18 lists the 21 most dominant taxa of Rock and Non-Rock substrates. Within each substrate category the values are adjusted as percentages of the most abundant taxon in each category. For Rock substrates *Jubula pennsylvanica* was the most abundant taxon with a cumulative dominance value of 304. The relative dominance value for *Jubula* was set at 100 percent, and scores for all other taxa were adjusted as a percent relative to *Jubula*. Data for the Non-Rock substrate were treated the same; where the 100 percent value was based on the greatest abundance of *Thuidium delicatulum*.

The TWINSPAN first level of analysis for samples used the dominant taxa of Rock

Table 18: Dominant taxa and relative dominance values for rock and non-rock substrates. Values in bold-type represent the dominant taxa within each substrate class.

Taxa	Rock	Non-Rock
Atrichum undulatum	24	**71.7**
Cephalozia spp.	9	**65.2**
Hygrohypnum eugyrium	**20.4**	0
Hypnum spp.	24	**42.4**
Jubula pennsylvanica	**100**	8.6
Lejunea spp.	**26.6**	5.4
Mnium hornum	25	57.6
Nowellia curvifolia	0	**19.6**
Philonotis fontana	17.1	8.7
Plagiochila porelloides	**87.2**	20.7
Plagiomnium ciliare	8.9	21.7
Platyhypnidium riparioides	**26**	1
Platylomella lescurii	**33.9**	0
Porella pinnata	**26**	1
Pseudotaxiphyllum elegans	16.4	0
Rhizomnium punctatum	**42.4**	19.6
Riccardia spp.	5.6	**31.5**
Scapania nemorosa	**55.3**	23.9
Scapania undulata	18.1	6.5
Thuidium delicatulum	49	**100**
Trichocolea tomentella	2.6	**25**

and Non-Rock substrates to identify if there was a floristic difference between the two substrate classes based on the presence and abundance of certain taxa that comprised the core associates of each substrate type. Figure 5 indicates the division of samples into Rock and Non-Rock substrates based on the cut level defined by *Hygrohypnum eugyrium*. The Twinspan-out RTF file that reports the steps and statistics for the analysis indicated the cut level was supported by an eigenvalue = 0.2771; roughly meaning that about 25% of the variability in the data was accounted for by the division of the two substrates in the dendrogram based on the cut level established by *Hygrohypnum eugyrium*.

Figure 6 indicates the division of taxa and produces a dendrogram through three cut-levels. The TWINSPAN analysis of taxa resulted in three cut levels forming six divisions of the 21 dominants of the Rock and Non-Rock substrates. Level I , with an eigenvalue = 0.7821, essentially establishes the cluster of taxa that corresponds to the first division of taxa associated with Rock, comprising ten taxa and the remaining 11 taxa less clearly discriminated as Non-Rock taxa. The Level II (Rock), with an eigenvalue = 0.4509, splits into two Divisions. The first Division consists of *Hygrohypnum eugyrium, Platyhypnidium riparioides, Platylomella lescurii, Porella pinnata*, and *Pseudotaxiphyllum elegans* and represents taxa associated with the conditions of greatest moisture. The second Division consists of *Jubula pennsylvanica, Lejeunea spp., Plagiochila porelloides, Rhizomnium punctatum*, and *Scapania nemorosa* and represents taxa associated with conditions of lesser moisture, although still in contact with reliable moisture. The Level II (Non-Rock) is split into two Divisions of nine (9) and two (2) taxa, supported by an eigenvalue = 0.5989. The cluster of nine (9) taxa is divided further in Level III into four (4) taxa: *Mnium hornum, Philonotis fontana, Plagiomnium ciliare*, and *Scapania undulata*, and a second cluster of five (5) taxa: *Atrichum undulatum, Cephalozia spp., Hypnum spp., Riccardia spp.* and *Thuidium delicatulum*, supported by an eigenvalue = 0.3019. These latter five (5) taxa can be combined with two (2) residual taxa, *Trichocolea tomentella* and *Nowellia curvifolia* to comprise an association of seven (7) Non-Rock taxa. The median cluster of *Mnium hornum, Philonotis fontana, Plagiomnium ciliare*, and *Scapania undulata* are interpreted to be generalist taxa without strong substrate fidelity, and, as reflected by their relative dominance values, are affiliated with both Rock and Non-Rock substrates. It was expected that the divisions of Non-Rock taxa would be more complicated, and less obvious, due to the lumping of Trees, Logs, Humus, and Soil within the Non-Rock substrate category.

Non-Rock Substrates

The entire taxa Excel Spreadsheet for Non-Rock Substrates included 363 records of occurrence, distributed as follows: Trees = 51 records, Logs = 196 records, Humus = 49 records and Soil = 94 records. The variability in occurrence records roughly reflects the proportion of substrate types found in the study area.

The analysis of Non-Rock substrates by TWINSPAN produced dendrograms useful and consistent with the interpretation of taxa associations along implied environmental gradients. The relative dominance taxa scores for Soil, Humus, Logs and Trees is

Figure 5. Twinspan dendrogram comparing samples, all rock substrates and all non-rock substrates.

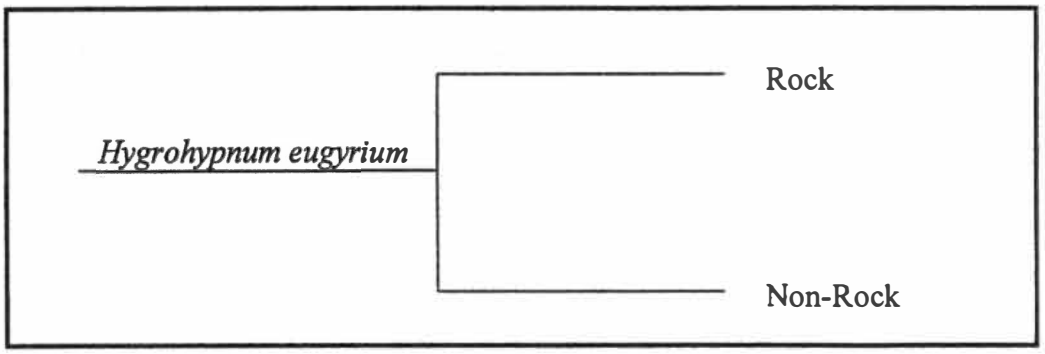
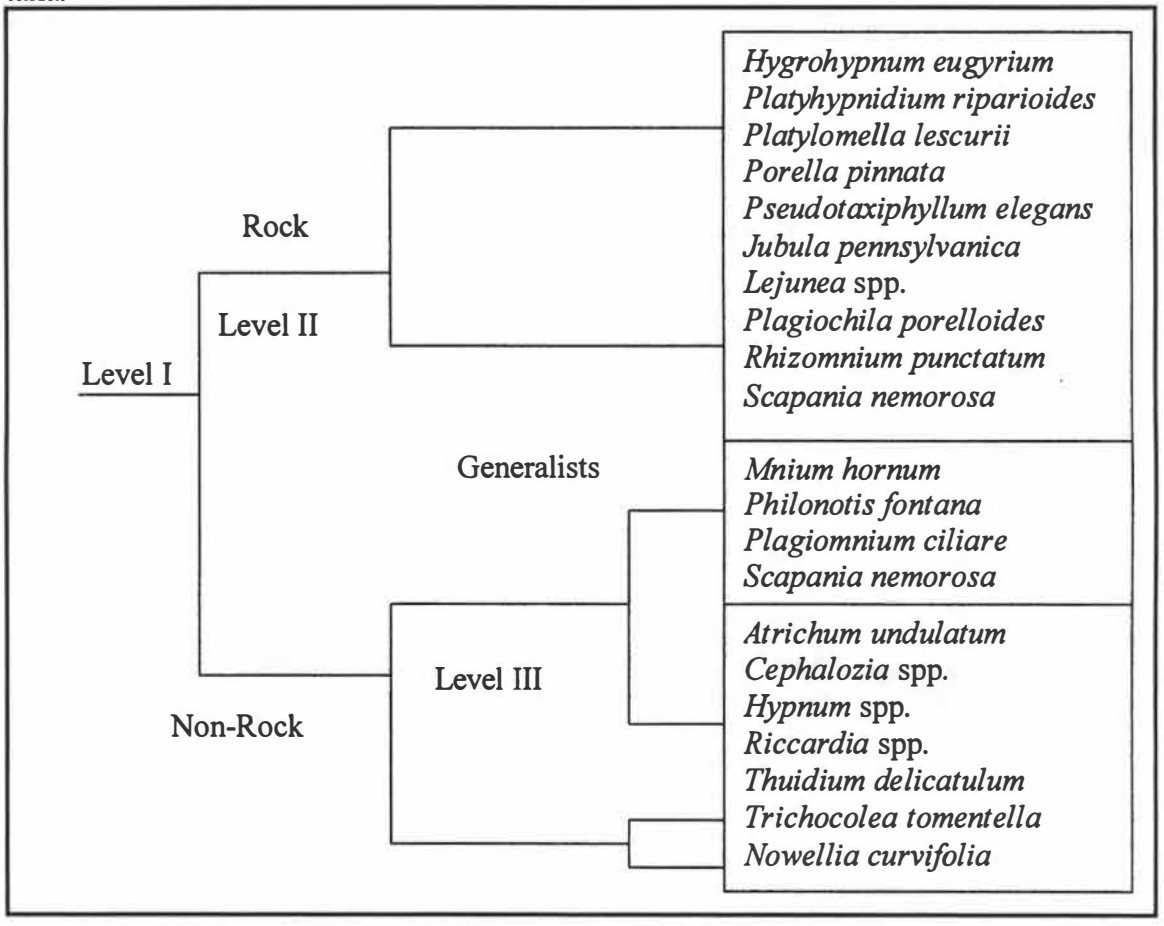


Figure 6: Twinspan taxa dendrogram comparing dominant all rock taxa and all non-rock taxa.



presented in Table 19. The dendrogram (Figure 7) of non-rock sample substrates (Trees, Logs, Humus, and Soil) separates Trees and Logs as more similar in taxa associations, from Humus and Soil. The data that support this division are reasonable since these substrates are relational to each other. Trees eventually succumb to death and fall to become logs. Logs undergo decomposition cycles that degrade them into accumulations of humus. Humus becomes dispersed and consolidated with mineral soils resulting in a general condition of soil substrate.

The TWINSPAN analysis for Non-Rock samples used the dominant taxa of Soil, Humus, Logs and Trees. Figure 7 indicates the division of Samples into Soil and Humus separated from Logs and Trees at cut Level I defined by *Frullania asagrayana,* with an eigenvalue = 0.1468. The second cut Level II separates Logs from Trees defined by *Atrichum undulatum* with an eigenvalue = 0.5515; and separates Soil from Humus defined by *Cephalozia bicuspidata* with an eigenvalue = 0.2652. Although the Level I cut is only weakly supported by its eigenvalue, it is a sensible division because of the substrate dissimilarities of Soil and Humus versus Logs and Trees. The Level II cut is well-supported by the eigenvalues.

Figure 8 indicates the division of taxa and produces a dendrogram through five (5) cut-levels. Cut Level I essentially separates Log and Tree taxa from the residual of the division, Humus and Soil supported by an strong eigenvalue = 0.8172. Among the 21 dominant taxa, 11 are clustered toward the Log and Tree cluster and separated from the remaining nine (9) which cluster toward Humus and Soil. Cut Level II further restricts the taxa affiliating with Logs and Trees with an eigenvalue = 0.3346. Cut Level III separates taxa found on Trees: *Drepanolejeunea appalachiana, Frullania asagrayana, Harpalejeunea ovata* ssp. *integra, Radula tenax,* and *Schistidium rivulare* from taxa of Logs: *Hookeria acutifolia, Nowellia curvifolia,* and *Riccardia palmata* supported by an eigenvalue = 0.2188. *Hypnum* spp., *Chiloscyphus cuspidatus*, and *Lejeunea lamacerina* favor Logs and Trees, but also occur on Soil and Humus in minor amounts.

The division of taxa along preferences for Humus or Soil is more difficult. Only *Cephalozia bicuspidata,* and *Plagiomnium ciliare* occupy soil and exclude Humus. Comparatively, only *Philonotis fontana* occupies Humus and excludes soil. No further divisions within cut Level II for Humus and Soil produce taxa clusters that have strong fidelities for either Humus or Soil. The sensible interpretation is that Humus and Soil do not host exclusive associations of taxa; but represent a clinal substrate that combines blends of many taxa that are generalized to a soil-based substrate.

A final TWINSPAN analysis was performed to compare the riparian zone transects of East Bank, Center Stream, and West Bank. The majority of samples in the riparian zone occurred on rock substrate and only data from this substrate were analyzed. Data were organized in a similar procedure as the Rock and Non-Rock analyses. The dominant taxa and their relative dominance values are shown in Table 20.

A direct inspection of Table 20 indicates that all 16 of the most dominant taxa are

Table 19: Dominant taxa and relative dominance values for non-rock substrates: Soil, Humus, Logs and Trees. Values in bold-type represent the dominant taxa within each substrate class.

Taxa	Soil	Humus	Logs	Trees
Atrichum undulatum	**60**	**47**	4	0
Cephalozia bicuspidata	13	0	**39**	0
Cephalozia lunulifolia	**27**	**24**	**37**	0
Chiloscyphus cuspidatus	7	0	4	**53**
Drapanolejunea appalachiana	0	0	0	**53**
Frullania asagrayana	0	0	8	**47**
Harpalejunea ovata ssp. *integra*	0	0	0	**100**
Hookeria acutifolia	0	0	**22**	0
Hypnum spp.	3	0	**61**	**53**
Lejunea lamacerina	10	0	**29**	13
Mnium hornum	**50**	**100**	**24**	**60**
Nowellia curvifolia	0	0	**37**	0
Philonotis fontana	0	**47**	0	0
Plagiomnium ciliare	**43**	0	6	**27**
Plagiothecium laetum	10	**53**	0	**27**
Radula tenax	0	0	8	**73**
Riccardia palmata	0	0	**39**	0
Scapania nemerosa	10	12	**29**	0
Schistidium rivulare var. *rivulare*	0	0	0	**47**
Thuidium delicatulum	**100**	**41**	**100**	7
Trichocolea tomentella	**40**	12	10	0

Figure 7: Twinspan samples dendrogram comparing non-rock substrates (samples): Soil, Humus, Logs, and Trees.

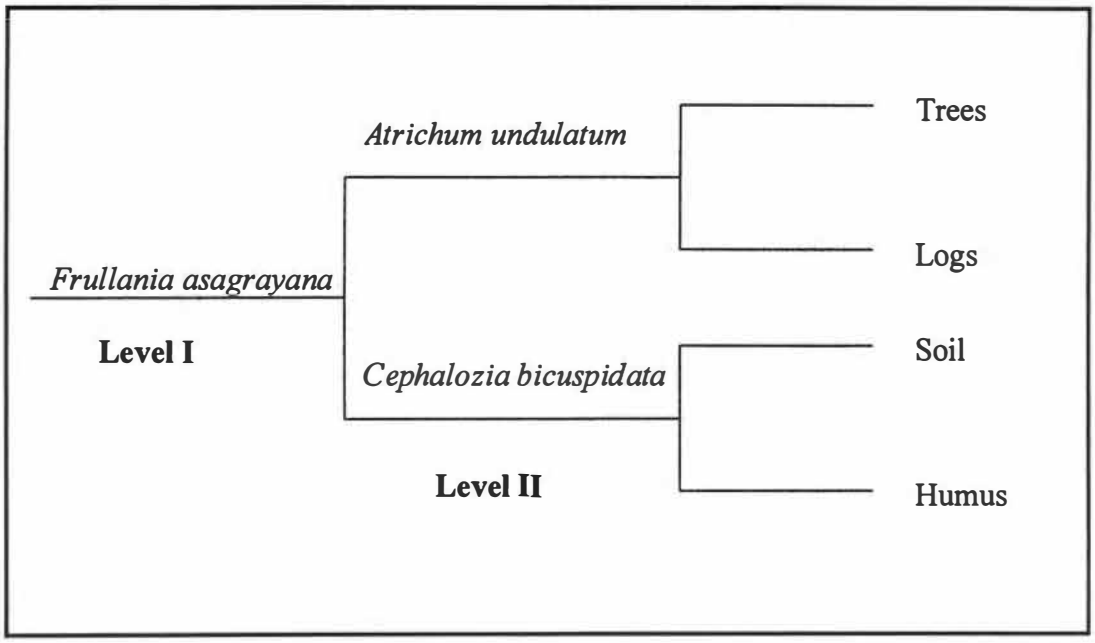


Figure 8: Twinspan taxa dendrogram comparing Non-Rock taxa on Soil, Humus, Logs, and Trees. EV = eigenvalues.

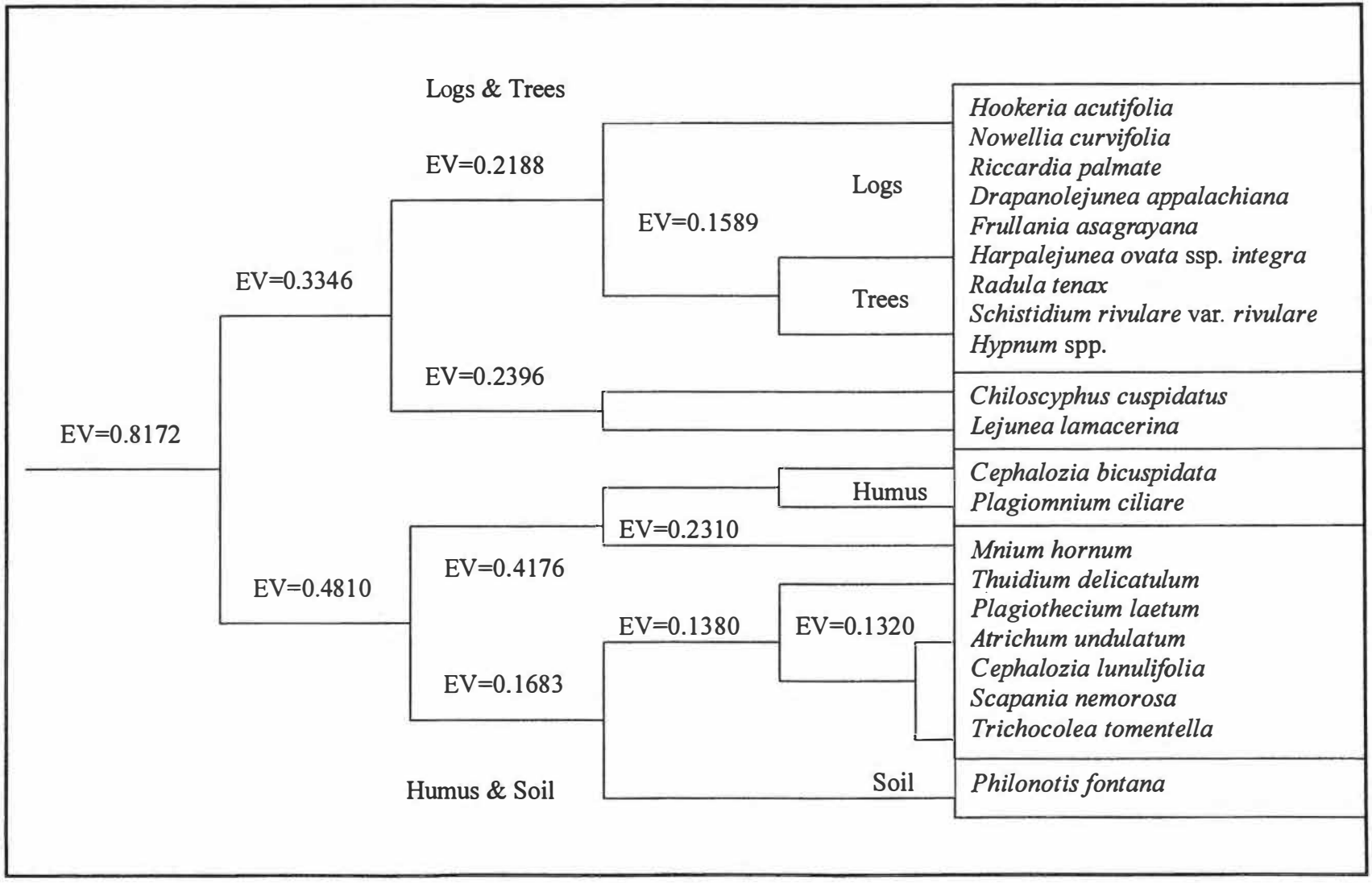


Table 20: Dominant taxa and relative dominance values for rock substrates of the East Bank, Center Stream, and West Bank of the Riparian Zone.

Taxa	**East**	**Center**	**West**
Jubula pennsylvanica	90	95	100
Plagiochila porelloides	100	100	54
Scapania nemerosa	57	21	77
Thuidium delicatulum	52	33	54
Rhizomnium punctatum	35	30	55
Platylomella lescurii	21	59	19
Platyhypnidium riparioides	43	27	7
Porella pinnata	20	33	22
Mnium hornum	16	11	41
Atrichum undulatum	29	18	24
Hypnum spp.	25	15	31
Lejunea lamacerina	23	17	17
Hygrohypnum eugyrium	36	6	17
Scapania undulata	18	23	11
Philonotis fontana	24	25	2
Pseudotaxiphyllum elegans	13	0	32

generally distributed on rock along East Bank, Center Stream, and West Bank transects. The TWINSPAN analysis of these data provided no insights into possible divisions of samples into differences among transects, nor did it offer useful divisions of taxa into clusters that might be aligned with transects.

The Samples dendrogram generated by TWINSPAN yielded a single Level I division into West and Center transects separated from East transect. However, this was only supported by an eigenvalue = 0.0370 which is considered too weak to accept the division. Furthermore, only three (3) taxa were indicated as having a slight preference for the East transect: *Mnium hornum, Scapania undulata*, and *Pseudotaxiphyllum elegans*; all of which occurred in the ranges of low relative dominance values. The remaining 13 taxa were indicated as having no sample preference.

In sum, the riparian zone is comprised of the 16 dominant taxa favoring the generalized conditions of the gorge where abundant moisture; high humidity and uniform, cool temperatures prevail. These conditions combined with the abundance of rock substrate which acts as a heat sink to mollify minor variations of the microclimate, likely account for the common and widespread occurrence of the dominant taxa. Possible divisions of this single community structure have been presented in the section on direct analysis (p. 54) in the discussions of Societies and Facies on Rock substrates.

CHAPTER IX
DISCUSSION

Taxonomic Diversity

Among the collections from Falls Branch Falls 145 taxa representing 49 families were identified (21 in *Hepaticae*, one in *Anthocerotae* and 28 in *Musci*). See Appendix 1 for taxa and families represented. The best represented families were Hypnaceae with 11 taxa; Lejuneaceae with eight (8) taxa; Brachytheciaceae with seven (7) taxa. Of the hepatics the best represented families were Lejuneaceae with eight (8) taxa; Cephaloziaceae; Geocalycaceae and Jungermanniaceae each with six (6) taxa. Of the mosses the best represented families were Hypnaceae with 11 taxa; Brachytheciaceae with seven (7) taxa; Amblystegiaceae and Dicranaceae each with six (6) taxa. The Taxonomic Ratio of mosses: liverworts for Falls Branch Falls is 79:65 or 1.22. According to Smith and Davison (2001), an index of less than two (2) is indicative of greater total species richness. Thus, the index of 1.22 indicates great species richness within Falls Branch Falls.

Several categories of important taxa clusters are recognized to acknowledge taxa of special interest, or importance, for evaluating the significance of the Falls Branch Scenic Area within the designated Citico Creek Wilderness Area of Cherokee National Forest:

1. Taxa records for Cherokee National Forest and Monroe County, Tennessee.
2. Taxa of state listed concern for TN, NC, GA, KY and VA.
3. Taxa of general or specific geographic affinity,

    A) Endemic (Southern Appalachian) elements
    B) Cosmopolitan elements
    C) Circumboreal (transcontinental and intercontinental, northern) elements
    D) North American (widespread) elements
    E) Eastern North American elements
    F) Southern (Mexico, Carribbean, Central America, South America) affinities

Endemic Southern Appalachian elements constitute taxa confined globally to the Appalachian Mountain system (Blue Ridge mountains and the Cumberland/Allegheny Plateau).

Cosmopolitan elements have been variously defined by Crum and Anderson (1981) and Ireland (1982). Used here, cosmopolitan denotes the occurrence of taxa, widespread globally, across the northern hemisphere continents of Asia, Europe, and North America; and occurring elsewhere in the southern hemisphere.

Circumboreal elements constitute taxa widely distributed across the northern hemisphere continents of Asia, Europe, and North America. Also included here, are

taxa with wide disjunctive distributions represented by: North American-European-Asian; Eastern North American-Asian; Eastern North American-European; and Eastern North American/Appalachian-Pacific Northwestern disjunction patterns.

North American (widespread) elements constitute taxa occurring generally across North America. Many of these represent primary ranges in eastern and western North America connected across the northern states and boreal zone of Canada, often penetrating south along the mountain systems of eastern and western North America. In many cases, these taxa reflect a boreal affinity, confined within North America.

Eastern North American elements constitute taxa occurring in the eastern U.S. and Canada (east of the mid-western prairie region). Inclusive to this category are taxa occurring in the Great Lakes Region, Ozarkian Region, east to the Maritime Provinces of Canada, and south to Florida.

Southern (Mexico, Caribbean, Central America, South America) affinities denote taxa apparently reaching their northern geographic limit in eastern North America (often the southern Appalachians west to the Ozarks), and occurring in the subtropical/tropical regions of North America; and may extend into South America.

Status of Special Interest Taxa

The status of the special interest taxa by geographic scope are presented in Table 21. The U. S. Forest Service, the Nature Conservancy and state Natural Heritage Programs, operating under the state Departments of Environment and Conservation list and moniter taxa of special interest. One hundred and seven (107) taxa are reported in Table 21 and are representative of a long list of taxa that have been accorded some special status designation by one of the above agencies for monitoring and/or protection. Taxa selected by these agencies for listing serve various purposes regarding protection and conservation agendas.

In recent decades members of the general public, influenced by such organizations as the Sierra Club, the World Wildlife Foundation, the Nature Conservancy and Discovering Life in America, have become more aware and interested in conservation and biodiversity issues.

Rankings used in Table 21 are taken from state Natural Heritage Programs at:

Tennessee:	www.state.tn.us/environment/nh/nonvasc.html;
Georgia:	www.dnr.state.ga.us/dnr/wild/natural/sppl t.htm;
North Carolina:	ftp.abi.org/pub/nhp/us/nc/plants.txt;
Kentucky:	http://www.kynaturepreserves.org;
Virginia:	http://www.dcr.state.va.us/dnh.

The rankings for Cherokee National Forest were indicated by Mark Pistrang through personal communication.

Table 21: Regional Status, State, National and Global ranking of special interest taxa found at Falls Branch.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Anastrophyllum michauxii		S3						
Anastrophyllum minutum		S1S2						
Andreaea rothii		S3						
Anomodon attenuatus		S5						
Anomodon rostratus		S5						
Anomodon rugelii		S3			T			
Atrichum undulatum		S5						
Bartramia pomiformis		S4						
Bazzania trilobata		S4S5						
Blepharostoma trichophyllum		S3						
Blindia acuta		S1						
Brachythecium plumosum		S5					N5	G5
Brachythecium rivulare		S4					N4	
Brachythecium rutabulum		S1					N3	

Table 21. Continued

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Brachythecium salebrosum		S4					N4	
Brotherella recurvans		S4						
Bryhnia novae-angilae		S2						
Calypogeia fissa		S1						
Cephalozia bicuspidata		S5					N5	G5
Chiloscyphus appalachianus	S		S1					G1G2Q
Cratoneuron filicinum		S1						
Ctenidium malacodes		S4						
Dicranella heteromalla		S4						
Dicranodontium denudatum		S4						
Dicranum fulvum		S4						
Dicranum scoparium		S5					N5	G5
Dicranum viride		S2						

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Diphyscium cumberlandianum		S2					N3	G3
Diplophyllum apiculatum	S							
Drapanolejunea appalachiana	S	S1	S1				N2?	G2?
Fissidens appalachensis	S	S1					N1	G1
Fissidens bryoides		S3					N5	G5
Fissidens dubius		S5					N5	G5
Fontinalis dalecarlica		S1						
Frullania asagrayana		S5					N5	G5
Frullania plana	LR		S2					G4
Haplohymenium triste		S5						
Heterocladium macounii		S2						
Heterophyllum affine		S3						
Hookeria acutifolia		S4						

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Hygrohypnum eugyrium		S2S3						
Hygrohypnum micans		S2						
Hygrohypnum molle		S1						
Hypnum curvifolium		S4						
Hypnum fertile		S4						
Hypnum imponens		S4		S2?				G5
Hypnum pallescens		S3S4						
Isopterygiopsis muelleriana		S3						
Isopterygium tenerum		S5						
Jubula pennsylvanica		S4						
Kurzia sylvatica		S4						
Lejunea laetevirens				S2?				G5
Lejunea lamacerina ssp. *geminata*				S2?				G5T3T4

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Lejunea ruthii						SU		G3G4
Lejunea ulicina		S4					N5	G5
Leucobryum albidum		S5					N5	G5
Leucobryum glaucum		S4					N5	G5
Leucodon julaceus		S4						
Leucolejunea clypeata				S2?				G4
Loeskeobryum brevrostre				S3?				G5
Marsupella emarginata	S							
Megaceros aenigmaticus	S	S1S2	S2S3				N?	G2G3
Mnium hornum		S4					N5	G5
Mnium thomsonii		S1						
Nardia lescurii	S					SU		G3?
Neckera pinnata		S3			T			
Nowellia curvifolia		S5						
Oncophorus rauii		S2			E		N3	G3
Philonotis fontana		S3						

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Plagiochila caduciloba	S	S2	S1	S1?			N3	G2Q
Plagiochila europhyllon ssp. *echinata*	S	S2					N2N3	G2G3
Plagiochila sullivantii	S	S2	S2	SH			N3	G2T2
Plagiomnium ciliare		S5					N5	G5
Plagiothecium cavifolium		S5					N5	G5
Plagiothecium denticulatum		S3						
Plagiothecium laetum		S3						
Platyhypnidium riparioides		S4						
Platylomella lescurii		S4						
Polytrichum pallidisetum		S2S3			T			
Porella wataugensis	S	S1	S1				N1	G1G2Q

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Pseudotaxiphyllum distichaceum		S2						
Pseudotaxiphyllum elegans		S3						
Pylaisiadelpha tenuirostris		S4						
Racomitrium aciculare		S3						
Radula sullivantii	S	S2	S2				N3N4	G3
Radula tenax	LR	S3	S2			SU	N4	G3G4
Rhizomnium appalachianum		S3					N4	G4
Rhizomnium punctatum		S4					N5	G5
Scapania nemorosa		S5					N5	G5
Scapania undulata		S3					N4	G5
Schistidium rivulare var. *rivulare*		S2						
Schwetschkeopsis fabronia		S4					N4	
Sematophyllum demissum		S4S5					N5	

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Sematophyllum marylandicum		S3						
Solenostoma crenuliformis		S1?						
Solenostoma pumlium		S1						
Sphagnum flexuosum			S1			S1S2	G5	
Sphagnum inundatum						S1S2	G4	
Sphagnum palustre		S4						
Taxiphyllum deplanatum		S4						
Tetraphis pellucida		S4						
Thamnobryum alleghaniense		S4						
Thuidium delicatulum		S4					N5	G5
Tortella humilis		S4						
Tritomaria exsecta		S3					N5	G5
Ulota crispa		S3					N4	G4

Table 21. Continued.

Taxa	CNF	Tennessee State Ranking	North Carolina State Ranking	Georgia State Ranking	Kentucky State Ranking	Virginia State Ranking	National Ranking	Global Ranking
Weissia controversa		S4					N5	G5

CNF= Cherokee National Forest Rank
S = "sensitive species" in CNF
LR = Locally rare in CNF
S # = State Rank
N = National (USA) Rank
G = Global Rank
? = Inexact (Numeric) Rank
Q = Questionable (Numeric) Rank
U = Possibly rare, but status uncertain and more data needed
T = Threatened
H = Fromerly part of state biota with expectation that it may be rediscovered
E = Endangered

The designation of "S" (sensitive) by Cherokee National Forest indicates taxa that are officially recognized on the Regional Forester's Sensitive Species list. The taxa designater "LR" are considered to be locally rare and have no formal protection. They are however, tracked by Cherokee Natioanl Forest on the basis of potential viability concerns (Pistrang, 2003 personal communication).

The Tennessee Division of Natural Heritage (www.state.tn.us/environment/nh.html) defines state ranks as:

"S1: Extremely rare and critically imperiled in the state with five or fewer occurrences, or very few remaining individuals, or because of some special condition where the species is particularly vulnerable to extirpation from the state."

"S2: Very rare and imperiled within the state, six to 20 occurrences and less than 3000 individuals, or fewer remaining individuals, or because of some factor(s) making it vulnerable to extirpation from the state."

"S3: Rare and uncommon in the state, from 21 to 100 occurrences."

"S4: Widespread, abundant, and apparently secure within the state, though it may be quite rare in parts of its range, especially at the periphery, and is of long-term concern."

"S5: Demonstrably secure within apparently secure within the state, though it may be the state, though it may be quite rare in parts of its range, especially at the periphery."

The Nature Conservancy (http://biology.usgs.gov/npsveg/classification/sect4.html) and state Natural Heritage Programs define national ranks as:

"N1: Extremely rare and critically imperiled, generally with five or fewer occurrences

in the nation, or very few remaining individuals, or because of some special condition the species is particularly vulnerable to extirpation from the United States."

"N2: Very rare and imperiled, generally with six to twenty occurrences and less than 3000 individuals nationally, or because of some factor(s) vulnerable to extirpation."

"N3: Very rare and local in the United States or found locally in a restricted range, or because of other factors vulnerable to extirpation from the United States. Generally between 21 and 100 occurrences and fewer than 10,000 individuals."

"N4: Apparently secure nationally, though it may be quite rare in parts of its range, especially at the periphery. Thus, the plant id of long-term concern."

"N5: Demonstrably secure within the United States, though it might be quite rare in parts of its range, especially at the periphery."

The Nature Conservancy and the state Natural Heritage Programs define global ranks as:

"G1: Extremely rare and critically imperiled, generally with five or fewer occurrences in the world, or very few remaining individuals, or because of some special condition the species is particularly vulnerable to extinction."

"G2: Very rare and imperiled, generally with six to twenty occurrences and less than 3000 individuals, or because of some factor(s) vulnerable to extinction."

"G3: Very rare and local throughout its range or found locally in a restricted range, or because of other factors vulnerable to extinction throughout its range. Generally between 21 and 100 occurrences and fewer than 10,000 individuals."

"G4: Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery. Thus, the plant is of long-term concern."

"G5: Demonstrably secure globally, though it might be quite rare in parts of its range, especially at the periphery."

CHAPTER X
SUMMARY AND CONCLUSIONS

Thorough bryological investigation of the Falls Branch study site has produced new bryofloristic records and descriptive bryophyte community associations. The bryofloristic elements include specifically:

1. The discovery of a previously unknown site for the endemic anthocerophyte *Megaceros aenigmaticus*; a taxon of significance for Cherokee National Forest management.

2. Seventy-six (76) new bryophyte records for Monroe County and the Tellico Ranger District of Cherokee National Forest. (See Table 2 p. 24).

3. Determination of the presence of an extraordinarily rich bryoflora including a number of endemic, rare, threatened, and sensitive bryophyte taxa.

4. Description of dominant bryophyte assemblages into communities, societies and facies (associated taxa) occurring on rock and non-rock substrates under variable conditions of moisture and light.

5. An analysis of indicator communities and associations useful in predicting the presence of rare, threatened and sensitive bryophytes was developed.

Inventory

A total of 145 taxa were identified from 707 specimen and ecological gatherings, representing more than 1886 taxa identifications. Seventy-six (76) taxa are reported as new to Cherokee National Forest in Monroe County, Tennessee.

An analysis of apparent bryophyte communities, societies and facies indicative of the presence of various minute rare, threatened, sensitive and/or endemic bryophytes was preformed. This system of bryophyte associations strongly indicative of the potential presence of rare, threatened, sensitive and/or endemic bryophytes will be a useful conservation tool for both the immediate and distant future.

Most of the taxa in this study were collected from wet rocks in the shady stream bed of Falls Branch and from the spray zone around Falls Branch Falls. There are potentially many more taxa to be found in the future by concentrating collections on the surrounding slopes, trees, forest floor and the many rotting logs.

Conclusions

Results of this project will serve as a report of the richness of Falls Branch bryoflora for Cherokee National Forest to use in planning management and conservation efforts within Falls Branch Scenic Area; Citico Wilderness Area and the Forest. It will also serve as a baseline record of the bryofloristic richness in the Falls Branch area, which may be used for comparison and reference in future years.

This project also successfully demonstrated the utility of a plotless method of sampling which accomplishes a comprehensive inventory and gathers sufficient data for each taxon supporting community structure analysis.

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APPENDICES

APPENDICIES

Appendix 1: Taxa, listed by family, found at Falls Branch Falls.

Family	Hepatics	Author
Blepharostomaceae	*Blepharostoma trichophyllum*	(L.) Dumort.
Calypogiaceae	*Calypogeia fissa*	(L.) Raddi
Calypogiaceae	*Calypogeia muelleriana*	(Schiffn.) K. Muell.
Calypogiaceae	*Calypogeia sullivantii*	Aust.
Cephaloziaceae	*Cephalozia bicuspidata*	(L.) Dumort.
Cephaloziaceae	*Cephalozia connivens*	(Dicks.) Lindb.
Cephaloziaceae	*Cephalozia lunulifolia*	(Dumort.) Dumort.
Cephaloziaceae	*Nowellia curvifolia*	(Dicks.) Mitt.
Cephaloziaceae	*Odontoschisma denudatum*	(Nees) Dumort.
Cephaloziaceae	*Odontoschisma prostratum*	(Sw.) Trev.
Cephaloziellaceae	*Cephaloziella byssacea*	(Roth.) Warnst.
Conocephalaceae	*Conocephalum conicum*	(L.) Underwood
Geocalycaceae	*Chiloscyphus appalachianus*	(Schust.) Evans & Schust
Geocalycaceae	*Chiloscyphus cuspidatus*	(Nees) Eng. & Schust.
Geocalycaceae	*Chiloscyphus profundus*	(Nees) Eng. & Schust.
Geocalycaceae	*Chiloscyphus rivularis*	(Schrad.) Loeske
Geocalycaceae	*Harpanthus scutatus*	(Web. & Mohr.) Spruce
Gymnomitriaceae	*Marsupella emarginata*	(Ehrh.) Dumort.
Gymnomitriaceae	*Marsupella sphacelata*	(Gres.) Dumort.
Herbertaceae	*Herbertus aduncus* ssp. *tenuis*	(Evans) Miller & Scott
Jubulaceae	*Frullania asagrayana*	Mont.
Jubulaceae	*Frullania inflata*	Gott.
Jubulaceae	*Jubula pennsylvanica*	(Steph.) Evans
Jungermanniaceae	*Jamesoniella autumnalis*	(DeCond.) Steph.
Jungermanniaceae	*Jungermannia lanceolata*	L. emend. Schrad.
Jungermanniaceae	*Nardia lescurii*	(Aust.) Underw.
Jungermanniaceae	*Solenostoma crenuliformis*	(Aust.) Steph.
Jungermanniaceae	*Solenostoma obscurum*	(Evans) Schust.
Jungermanniaceae	*Solenostoma pumilum*	(With.) K. Muell.
Lejuneaceae	*Cololejunea biddlecomiae*	(Aust.) Evs.
Lejuneaceae	*Drapanolejunea appalachiana*	Schust.
Lejuneaceae	*Harpalejunea ovata* ssp. *integra*	Schust.
Lejuneaceae	*Lejunea laetevirens*	Nees & Mont.
Lejuneaceae	*Lejunea lamacerina* ssp. *geminata*	Schust.
Lejuneaceae	*Lejunea ruthii*	(Evans) Schust.
Lejuneaceae	*Lejunea ulicina* ssp. *ulicina*	(Tayl.) Tayl. *ex* G. L. & N.
Lejuneaceae	*Leucolejunea clypeata*	(Schwein.) Evans
Lepidoziaceae	*Bazzania trilobata*	(L.) S. Gray

Family	Hepatics	Author
Lepidoziaceae	*Kurzia sylvatica*	(Evans) Grolle
Lepidoziaceae	*Lepidozia reptans*	(L.) Dumort.
Lophoziaceae	*Anastrophyllum michauxii*	(Web.) Buch
Lophoziaceae	*Anastrophyllum minutum*	(Schreb. *ex* Cranz) Schust.
Lophoziaceae	*Tritomaria exsecta*	(Schmid.) Schiffn.
Lophoziaceae	*Tritomaria exsectiformis*	(Breidl.) Schiffn.
Metzgeriaceae	*Metzgeria conjugata*	Lindb.
Metzgeriaceae	*Metzgeria furcata*	(L.) Dumort.
Metzgeriaceae	*Metzgeria leptoneura*	Spruce
Pallaviciniaceae	*Pallavacinia lyellii*	(Hook.) Gray
Pelliaceae	*Pellia epiphylla*	(L.) Lindb.
Plagiochilaceae	*Plagiochila caduciloba*	Blomq.
Plagiochilaceae	*Plagiochila europhyllon* ssp. *echinata*	(Schust.) Inoue
Plagiochilaceae	*Plagiochila porelloides*	Lindenb.
Plagiochilaceae	*Plagiochila sullivantii*	G. *ex* Evs.
Porellaceae	*Porella pinnata*	L.
Porellaceae	*Porella platyphylloidea*	(Schwein.) Lindb.
Radulaceae	*Radula obconica*	Sulliv.
Radulaceae	*Radula sullivantii*	Aust.
Radulaceae	*Radula tenax*	Lindb.
Radulaceae	*Radula voluta*	Tayl.
Ricciaceae	*Riccardia multifida*	(L.) S. Gray
Ricciaceae	*Riccardia palmata*	(Hedw.) Carruth.
Scapaniaceae	*Diplophyllum apiculatum*	(Evans) Steph.
Scapaniaceae	*Scapania nemorosa*	(L.) Dumort.
Scapaniaceae	*Scapania undulata*	(L.) Dumort.
Trichocoleaceae	*Trichocolea tomentella*	(Ehrh.) Dumort.
Family	**Hornworts**	**Author**
Anthocerotaceae	*Megaceros aenigmaticus*	Schust.

Family	Mosses	Author
Amblystegiaceae	*Cratoneuron filicinum*	(Hedw.) Spruce
Amblystegiaceae	*Hygrohypnum eugyrium*	(BSG) Loeske
Amblystegiaceae	*Hygrohypnum luridum*	(Hedw.) Jenn.
Amblystegiaceae	*Hygrohypnum micans*	(Hedw.) Loeske.
Amblystegiaceae	*Hygrohypnum molle*	(Hedw.) Loeske.
Amblystegiaceae	*Platylomella lescurii*	(Sull. Ex Gray) Andrews
Andreaeaceae	*Andreaea rothii*	Web. &Mohr
Bartramiaceae	*Bartramia pomiformis*	Hedw.
Bartramiaceae	*Philonotis fontana*	(Hedw.) Brid.
Brachytheciaceae	*Brachythecium plumosum*	(Hedw.) BSG
Brachytheciaceae	*Brachythecium rivulare*	BSG
Brachytheciaceae	*Brachythecium rutabulum*	(Hedw.) BSG
Brachytheciaceae	*Brachythecium salebrosum*	(Web. & Mohr) BSG
Brachytheciaceae	*Bryhnia novae-angliae*	(Sull. & Lesq. *ex* Sull.) Grout
Brachytheciaceae	*Eurhynchium hians*	(Hedw.) Sande-Lac.
Brachytheciaceae	*Platyhypnidium riparioides*	(Hedw.) Dix.
Climaciaceae	*Climacium americanum*	Brid.
Dicranaceae	*Dicranella heteromalla*	(Hedw.) Schimp.
Dicranaceae	*Dicranodontium denudatum*	(Brid.) E. G. Britt. *ex* Williams
Dicranaceae	*Dicranum fulvum*	Hook.
Dicranaceae	*Dicranum scoparium*	Hook.
Dicranaceae	*Dicranum viride*	(Sull. & Lesq.) Lindb.
Dicranaceae	*Oncophorus rauii*	(Aust.) Grout
Diphysciaceae	*Diphyscium cumberlandianum*	Harvill
Fabroniaceae	*Schwetschkeopsis fabronia*	(Schwaegr.) Broth.
Fissidentaceae	*Fissidens appalachensis*	Zand.
Fissidentaceae	*Fissidens bryoides*	Hedw.
Fissidentaceae	*Fissidens dubius*	P. Beauv.
Fontinalaceae	*Fontinalis dalecarlica*	BSG
Grimmiaceae	*Racomitrium aciculare*	(Hedw.) Brid.
Grimmiaceae	*Schistidium rivulare* var. *rivulare*	(Brid.) Podp.
Hookeriaceae	*Hookeria acutifolia*	Hook. & Grev.
Hylocomiaceae	*Loeskeobryum brevirostre*	(Brid.) Fleisch. *ex* BSG
Hypnaceae	*Ctenidium malacodes*	Mitt.
Hypnaceae	*Hypnum curvifolium*	Hedw.
Hypnaceae	*Hypnum fertile*	Sendtn.
Hypnaceae	*Hypnum imponens*	Hedw.
Hypnaceae	*Hypnum pallescens*	(Hedw.) P.-Beauv.
Hypnaceae	*Isopterygiopsis muelleriana*	(Schimp.) Iwats.
Hypnaceae	*Isopterygium tenerum*	(Sw.) Mitt
Hypnaceae	*Pseudotaxiphyllum distichaceum*	(Mitt.) Iwats.

Family	Mosses	Author
Hypnaceae	*Pseudotaxiphyllum elegans*	(Brid.) Iwats.
Hypnaceae	*Taxiphyllum deplanatum*	(Burch. & Schimp. Ex Sull.) Fl.
Hypnaceae	*Taxiphyllum taxirameum*	(Mitt.) Fl.
Leskeaceae	*Anomodon attenuatus*	(Hedw.) Hub.
Leskeaceae	*Anomodon rostratus*	(Hedw.) Schimp.
Leskeaceae	*Anomodon rugellii*	(C. M.) Keissl.
Leskeaceae	*Haplohymenium triste*	(Ces. ex De Not.) Kindb.
Leucobryaceae	*Leucobryum albidum*	(Brid.) Lindb.
Leucobryaceae	*Leucobryum glaucum*	(Hedw.) Angstr.
Leucodontaceae	*Leucodon julaceus*	(Hedw.) Sull.
Mniaceae	*Mnium hornum*	Hedw.
Mniaceae	*Mnium thomsonii*	Schimp.
Mniaceae	*Plagiomnium ciliare*	(C. Mull.) T. Kop.
Mniaceae	*Rhizomnium appalachianum*	T. Kop.
Mniaceae	*Rhizomnium punctatum*	(Hedw.) T. Kop.
Neckeraceae	*Neckera pennata*	Hedw.
Neckeraceae	*Thamnobryum alleghaniense*	(C. Mull.) Niewl.
Orthotrichaceae	*Ulota crispa*	(Hedw.) Brid.
Plagiotheciaceae	*Plagiothecium cavifolium*	(Brid.) Iwats.
Plagiotheciaceae	*Plagiothecium denticulatum*	(Hedw.) BSG
Plagiotheciaceae	*Plagiothecium laetum*	BSG
Polytrichaceae	*Atrichum undulatum*	(Hedw.) P-Beauv.
Polytrichaceae	*Polytrichum pallidisetum*	Funck
Pottiaceae	*Oxystegus tenuirostris*	(Hook. & Tayl.) A. J. E. Smith
Pottiaceae	*Tortella humilis*	(Hedw.) Jenn.
Pottiaceae	*Wessia controversa*	Hedw.
Seligeriaceae	*Blindia acuta*	(Hedw.) BSG
Sematophyllaceae	*Brotherella recurvans*	(Mx.) Fl.
Sematophyllaceae	*Heterophyllum affine*	(Hook. *ex* Kunth) Fl.
Sematophyllaceae	*Pylaisiadelpha tenuirostris*	(Bruch & Schimp in Sull.) Buck
Sematophyllaceae	*Sematophyllum demissum*	(Wils.) Mitt.
Sematophyllaceae	*Sematophyllum marylandicum*	(C. M.) E. G. Britt.
Sphagnaceae	*Sphagnum flexuosum*	Dozy & Molk.
Sphagnaceae	*Sphagnum inundatum*	Russ.
Sphagnaceae	*Sphagnum palustre*	L.
Tetraphidaceae	*Tetraphis pellucida*	Hedw.
Thuidiaceae	*Heterocladium macounii*	Best
Thuidiaceae	*Thuidium delicatulum*	(Hedw.) BSG

Appendix 2: Entire data set from Falls Branch collections.

Key to Appendix 2.

Proportion
1= 60-100% of collection components
2= 30-59% of collection components
3= 10-29% of collection components
4= 5-9% of collection components
5= Less then 5% of collection components

Substrate
R= Rock
S= Soil
H= Humus
T= Tree
L1= New log
L2= Dead log
L3= Decomposed log.

Light
S= Shade
R= Reflected, diffused or filtered light
V= Very deep shade
D= Deep shade
H= Sun

Moisture
W= Wet
A= Aquatic/ submerged
M= Moist
D= Damp
C= Dry

Taxa	Number	Proportion	Substrate	Light	Moisture
Anastrophyllum michauxii	2000H021	3	R	R	M
Anastrophyllum michauxii	2000H032	1	R	R	D
Anastrophyllum michauxii	2000H018	2	R	S	D
Anastrophyllum michauxii	2000H123	3	R	V	D
Anastrophyllum minutum	2000H021	3	R	R	M
Anastrophyllum minutum	2000M168	3	R	D	D
Anastrophyllum minutum	2000H032	3	R	R	D
Andreaea rothii	2000H119	3	R	S	W
Anomodon attenuatus	2001H292	2	R	S	W
Anomodon attenuatus	2000M050	4	R	S	M
Anomodon attenuatus	2000H024	3	T	R	M
Anomodon attenuatus	2001M398	2	R	S	C
Anomodon attenuatus	2000M065	1	R	D	D
Anomodon rostratus	2000M022	1	L3	S	M

Taxa	Number	Proportion	Substrate	Light	Moisture
Anomodon rostratus	2000M026	2	T	S	C
Anomodon rostratus	2000M021	3	R	S	M
Anomodon rostratus	2000H046	1	R	V	D
Anomodon rugellii	2000M023	3	R	S	D
Atrichum undulatum	2000M093	2	S	S	W
Atrichum undulatum	2000M080	3	S	S	W
Atrichum undulatum	2001M199	1	S	H	M
Atrichum undulatum	2001M185	3	L2	S	D
Atrichum undulatum	2001H342	3	R	D	W
Atrichum undulatum	2001M331	1	R	S	W
Atrichum undulatum	2001M356	3	R	S	C
Atrichum undulatum	2000H115	4	R	S	W
Atrichum undulatum	2001M226	1	R	H	W
Atrichum undulatum	2001H332	4	R	S	W
Atrichum undulatum	2001M330	3	R	S	W
Atrichum undulatum	2001M280	1	R	S	D
Atrichum undulatum	2001M403	1	L3	S	D
Atrichum undulatum	2001M189	1	R	H	D
Atrichum undulatum	2001H271	4	R	S	A
Atrichum undulatum	2001M262	4	H	S	D
Atrichum undulatum	2001M404	3	L3	S	D
Atrichum undulatum	2001H192	4	S	S	W
Atrichum undulatum	2001M405	4	R	D	S
Atrichum undulatum	2001M238	1	R	S	W
Atrichum undulatum	2001M392	4	R	S	D
Atrichum undulatum	2001M222	1	R	S	W
Atrichum undulatum	2001H170	4	R	H	W
Atrichum undulatum	2000M132	2	R	S	A
Atrichum undulatum	2001M298	2	R	S	C
Atrichum undulatum	2001M256	1	R	H	D
Atrichum undulatum	2001M296	2	R	S	C
Atrichum undulatum	2001M176	2	L3	S	M
Atrichum undulatum	2001H231	2	R	S	W
Atrichum undulatum	2000M081	1	R	V	W
Atrichum undulatum	2001M372	2	R	D	S
Atrichum undulatum	2000H100	2	R	S	W
Atrichum undulatum	2001M264	4	R	S	W
Atrichum undulatum	2001M292	1	R	S	W
Atrichum undulatum	2001M218	1	H	H	W
Atrichum undulatum	2001M178	3	R	S	D
Atrichum undulatum	2000M059	1	SR	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Atrichum undulatum	2001M197	4	S	H	M
Atrichum undulatum	2001M272	1	R	S	D
Atrichum undulatum	2001H281	3	R	S	W
Atrichum undulatum	2001H349	2	R	S	D
Atrichum undulatum	2001M271	4	R	S	D
Atrichum undulatum	2001H142	2	S	S	D
Atrichum undulatum	2000M090	1	S	V	D
Atrichum undulatum	2001M198	1	R	S	W
Atrichum undulatum	2001M393	1	R	D	S
Bartramia pomiformis	2000M037	1	R	H	W
Bazzania trilobata	2001H285	1	T	S	D
Bazzania trilobata	2000H103	1	R	S	W
Bazzania trilobata	2001M181	3	T	S	C
Bazzania trilobata	2000M151	3	R	H	W
Bazzania trilobata	2001M340	S	R	D	W
Bazzania trilobata	2001H257	3	L3	S	W
Bazzania trilobata	2001M178	3	R	S	D
Bazzania trilobata	2001H252	2	R	S	W
Bazzania trilobata	2001H147	1	S	S	D
Bazzania trilobata	2000H025	1	L2	S	D
Bazzania trilobata	2001H146	1	R	S	D
Blepharostoma trichophyllum	2000M153	3	R	S	D
Blepharostoma trichophyllum	2000H034	1	R	D	D
Blepharostoma trichophyllum	2000H106	3	R	S	D
Blepharostoma trichophyllum	2000M073	3	R	H	W
Blepharostoma trichophyllum	2001H257	3	L3	S	W
Blepharostoma trichophyllum	2000M154	3	R	S	D
Blepharostoma trichophyllum	2001H277	3	R	S	A
Blepharostoma trichophyllum	2001M245	2	R	S	W
Blepharostoma trichophyllum	2000H038	3	R	S	W
Blepharostoma trichophyllum	2001H237	3	R	S	A
Blindia acuta	2000M105	1	R	H	W
Blindia acuta	2001H199	3	R	S	A
Blindia acuta	2001M212	1	R	H	W
Blindia acuta	2001M190	1	R	H	W
Blindia acuta	2001H178	3	R	S	W
Blindia acuta	2001H220	3	R	S	D
Blindia acuta	2001H263	1	R	D	W
Blindia acuta	2001M211	1	R	H	W
Blindia acuta	2001M194	2	R	S	W
Blindia acuta	2001M270	1	R	H	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Blindia acuta	2001M215	1	R	H	W
Blindia acuta	2001H165	4	R	S	W
Blindia acuta	2001M214	2	R	H	W
Blindia acuta	2001M203	1	R	H	W
Blindia acuta	2001H173	4	R	H	W
Blindia acuta	2001M338	2	R	D	W
Blindia acuta	2001H266	3	R	D	W
Blindia acuta	2000H069	2	R	V	W
Blindia acuta	2001H243	4	R	S	W
Blindia acuta	2001M193	1	R	H	W
Blindia acuta	2000M087	1	R	V	D
Blindia acuta	2000M140	1	R	S	A
Blindia acuta	2001M192	1	R	H	W
Blindia acuta	2001M196	1	R	S	W
Blindia acuta	2001H183	4	R	H	D
Blindia acuta	2001M216	1	R	H	W
Brachythecium sp.	2000M077	3	L3	S	D
Brachythecium sp.	2001M297	3	R	S	C
Brachythecium plumosum	2001M298	1	R	S	C
Brachythecium plumosum	2001M311	1	R	S	W
Brachythecium plumosum	2001M381	1	R	H	D
Brachythecium plumosum	2001M375	1	R	H	D
Brachythecium plumosum	2001M231	1	R	H	W
Brachythecium plumosum	2001M358	3	R	S	C
Brachythecium plumosum	2000M159	1	R	S	W
Brachythecium plumosum	2001M342	2	R	D	W
Brachythecium plumosum	2001M335	3	R	S	W
Brachythecium plumosum	2001M360	3	R	S	C
Brachythecium plumosum	2000M072	1	R	H	D
Brachythecium plumosum	2001M303	1	L3	S	W
Brachythecium plumosum	2001M307	1	R	S	W
Brachythecium plumosum	2001M377	1	R	D	S
Brachythecium rivulare	2001H306	2	R	S	A
Brachythecium rivulare	2001M367	1	R	S	A
Brachythecium rivulare	2001M372	1	R	D	S
Brachythecium rivulare	2001H308	4	R	S	A
Brachythecium rivulare	2001M187	1	H	H	D
Brachythecium rivulare	2000M076	1	S	S	W
Brachythecium rutabulum	2000M042	1	L3	S	W
Brachythecium rutabulum	2000M043	1	L3	H	W
Brachythecium salebrosum	2001M308	3	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Brotherella recurvans	2000M043	1	R	H	W
Brotherella recurvans	2001M182	1	L2	S	M
Brotherella recurvans	2001M180	1	L2	S	M
Brotherella recurvans	2001M268	3	R	S	D
Brotherella recurvans	2001H148	3	L3	S	W
Brotherella recurvans	2001M265	1	H	S	M
Brotherella recurvans	2001M184	2	L2	S	D
Brotherella tenuirostris	2001H338	4	L3	H	D
Bryhnia sp.	2001H155	2	R	D	W
Bryhnia sp.	2000M038	3	L3	H	D
Bryhnia novae-angliae	2001M369	2	R	S	D
Bryhnia novae-angliae	2001M207	1	R	D	W
Bryhnia novae-angliae	2001M264	2	R	S	W
Bryhnia novae-angliae	2001M209	3	R	D	W
Bryhnia novae-angliae	2001H265	3	R	S	W
Bryhnia novae-angliae	2001M346	3	R	S	W
Calypogeia fissa	2001H152	4	H	S	M
Calypogeia fissa	2001M248	S	R	S	D
Calypogeia fissa	2001M185	1	L2	S	D
Calypogeia fissa	2001H271	S	R	S	A
Calypogeia fissa	2001H157	4	R	D	W
Calypogeia fissa	2001H141	S	S	S	M
Calypogeia muelleriana	2000M142	3	R	S	D
Calypogeia muelleriana	2000H106	1	R	S	D
Calypogeia muelleriana	2000H100	3	R	S	W
Calypogeia muelleriana	2001M242	3	R	S	D
Calypogeia muelleriana	2000H114	3	R	S	W
Calypogeia muelleriana	2000H105	3	R	S	W
Calypogeia muelleriana	2001M263	4	R	S	D
Calypogeia muelleriana	2000H115	3	R	S	W
Calypogeia muelleriana	2001H192	1	S	S	W
Calypogeia muelleriana	2000H111	3	R	S	A
Calypogeia muelleriana	2001H155	4	R	D	W
Calypogeia muelleriana	2000H096	3	R/H	R	M
Calypogeia muelleriana	2000H107	3	R	S	A
Calypogeia muelleriana	2001H225	S	R	S	W
Calypogeia muelleriana	2001H252	4	R	S	W
Calypogeia muelleriana	2001M262	3	H	S	D
Calypogeia muelleriana	2000H123	1	R	V	D
Calypogeia muelleriana	2000H101	1	R	H	W
Calypogeia muelleriana	2000H124	3	R	S	M

Taxa	Number	Proportion	Substrate	Light	Moisture
Calypogeia muelleriana	2000H105	3	R	S	W
Calypogeia muelleriana	2000M156	2	R	S	W
Calypogeia muelleriana	2001M245	4	R	S	W
Calypogeia muelleriana	2000H102	1	R	S	A
Calypogeia sullivantii	2001H257	3	L3	S	W
Calypogeia sullivantii	2001H143	4	R	N	D
Calypogeia sullivantii	2000M155	3	R	S	D
Calypogeia sullivantii	2000H042	3	R	V	D
Cephalozia sp.	2000H106	3	R	S	D
Cephalozia sp.	2001M348	4	R	S	W
Cephalozia bicuspidata	2001H302	4	L2	S	W
Cephalozia bicuspidata	2001H259	3	L3	S	W
Cephalozia bicuspidata	2001H225	4	R	S	W
Cephalozia bicuspidata	2001H193	3	L3	S	W
Cephalozia bicuspidata	2001H257	2	L3	S	W
Cephalozia bicuspidata	2001H258	2	L3	S	W
Cephalozia bicuspidata	2001H170	4	R	H	W
Cephalozia bicuspidata	2001M240	4	R	H	D
Cephalozia bicuspidata	2001H298	S	R	S	A
Cephalozia bicuspidata	2001H304	4	R	D	S
Cephalozia bicuspidata	2001M288	2	R	S	W
Cephalozia bicuspidata	2001H183	4	R	H	D
Cephalozia bicuspidata	2001H249	4	R	S	M
Cephalozia bicuspidata	2000M162	4	S	S	D
Cephalozia bicuspidata	2001H208	1	L2	S	W
Cephalozia bicuspidata	2001H187	4	R	S	W
Cephalozia bicuspidata	2000H127	3	R	S	M
Cephalozia bicuspidata	2000H123	3	R	V	D
Cephalozia bicuspidata	2001H347	4	L3	S	D
Cephalozia connivens	2001H257	3	L3	S	W
Cephalozia connivens	2001H338	3	L3	H	D
Cephalozia lunulifolia	2001H257	1	L3	S	W
Cephalozia lunulifolia	2001M183	4	L3	S	W
Cephalozia lunulifolia	2001M172	4	L3	S	D
Cephalozia lunulifolia	2001H347	1	L3	S	D
Cephalozia lunulifolia	2000H124	4	R	S	M
Cephalozia lunulifolia	2001H141	4	S	S	M
Cephalozia lunulifolia	2001H143	4	R	N	D
Cephalozia lunulifolia	2001H259	3	L3	S	W
Cephalozia lunulifolia	2001M262	4	H	S	D
Cephalozia lunulifolia	2000H034	2	R	D	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Cephalozia lunulifolia	2000H118	4	R	S	W
Cephalozia lunulifolia	2001M180	4	L2	S	M
Cephalozia lunulifolia	2000M159	3	R	S	W
Cephalozia lunulifolia	2001H149	3	R	S	D
Cephalozia lunulifolia	2001H258	2	L3	S	W
Cephalozia lunulifolia	2000M158	4	S	S	W
Cephaloziella byssacea	2001H193	3	L3	S	W
Chiloscyphus appalachianus	2001H297	3	R	S	A
Chiloscyphus appalachianus	2001M364	3	R	S	A
Chiloscyphus appalachianus	2000M167	2	S	S	W
Chiloscyphus appalachianus	2001H309	2	R	S	A
Chiloscyphus appalachianus	2001H287	3	R	S	W
Chiloscyphus appalachianus	2000M131	2	R	S	A
Chiloscyphus cuspidatus	2001M372	4	R	D	S
Chiloscyphus cuspidatus	2001M233	4	R	S	W
Chiloscyphus cuspidatus	2001H148	2	L3	S	W
Chiloscyphus cuspidatus	2001H313	4	T	S	D
Chiloscyphus cuspidatus	2001H321	3	R	S	W
Chiloscyphus cuspidatus	2001H313	4	T	S	D
Chiloscyphus cuspidatus	2000H085	1	R	S	A
Chiloscyphus rivularis	2001H323	1	R	S	A
Chiloscyphus rivularis	2000H083	2	R	S	A
Chiloscyphus rivularis	2000M069	2	R	S	A
Chiloscyphus rivularis	2000H050	1	R	S	A
Chiloscyphus rivularis	2000H113	3	R	S	W
Chiloscyphus rivularis	2000M144	4	R	H	D
Chiloscyphus rivularis	2000H074	1	R	H	A
Chiloscyphus rivularis	2001H319	1	R	S	A
Chiloscyphus rivularis	2000H075	2	R	H	A
Chiloscyphus rivularis	2001H318	1	R	S	A
Chiloscyphus rivularis	2001H235	2	R	S	A
Chiloscyphus rivularis	2000M079	2	R	V	A
Chiloscyphus rivularis	2000M134	1	R	S	A
Chiloscyphus rivularis	2000H079	2	R	S	A
Chiloscyphus sp.	2000H110	2	R	S	W
Climacium americanum	2001M210	1	H	H	W
Cololejunea biddlecomiae	2001H190	3	R	S	As
Conocephalum conicum	2001H245	1	R	S	W
Cratoneuron filicinum	2001H181	1	R	S	W
Ctenidium malacodes	2001M379	1	R	H	D
Ctenidium malacodes	2001M405	1	R	D	S

Taxa	Number	Proportion	Substrate	Light	Moisture
Ctenidium malacodes	2001H286	4	R	S	W
Ctenidium malacodes	2001M305	1	R	S	W
Ctenidium malacodes	2001M356	2	R	S	C
Ctenidium malacodes	2000M077	1	L3	S	D
Ctenidium malacodes	2000M021	3	R	S	M
Ctenidium malacodes	2001M387	4	R	D	D
Ctenidium malacodes	2001M396	3	R	S	W
Dicranaceae	2000H020	3	R	R	M
Dicranaceae	2000H062	3	R	V	D
Dicranella sp.	2001M245	4	R	S	W
Dicranella sp.	2000H118	3	R	S	W
Dicranella heteromalla	2000H123	3	R	V	D
Dicranella heteromalla	2001M315	2	R	S	W
Dicranella heteromalla	2000H122	3	R	S	M
Dicranella heteromalla	2000M158	1	S	S	W
Dicranella heteromalla	2000M156	3	R	S	W
Dicranella heteromalla	2000H102	3	R	S	A
Dicranella heteromalla	2000M162	1	S	S	D
Dicranella heteromalla	2000H127	2	R	S	M
Dicranella heteromalla	2000M153	1	R	S	D
Dicranella heteromalla	2001M263	1	R	S	D
Dicranella heteromalla	2000H124	2	R	S	M
Dicranodontium denudatum	2001M241	1	R	S	D
Dicranodontium denudatum	2001M204	S	H	H	D
Dicranodontium denudatum	2000M142	1	R	S	D
Dicranodontium denudatum	2000M152	1	R	S	W
Dicranodontium denudatum	2000M137	3	R	H	C
Dicranodontium denudatum	2001M268	3	R	S	D
Dicranodontium denudatum	2001M248	2	R	S	D
Dicranodontium denudatum	2000M019	3	R	S	D
Dicranodontium denudatum	2001M186	2	L2	S	D
Dicranodontium denudatum	2001M243	4	R	S	D
Dicranodontium denudatum	2000M016	1	H	S	D
Dicranum sp.	2000H057	3	R	S	D
Dicranum sp.	2000H066	4	R	D	D
Dicranum fulvum	2001M354	2	R	S	W
Dicranum fulvum	2001M177	2	R	S	D
Dicranum fulvum	2000M151	2	R	H	W
Dicranum fulvum	2000H032	3	R	R	D
Dicranum fulvum	2000M024	3	L1	S	D
Dicranum scoparium	2001M267	1	H	H	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Dicranum scoparium	2001M171	1	S	S	D
Dicranum viride	2000M036	1	H	H	D
Dicranum viride	2000M060	1	L3	H	D
Diphyscium cumberlandianum	2001M348	1	R	S	W
Diplophyllum apiculatum	2000M162	2	S	S	D
Diplophyllum apiculatum	2000H127	1	R	S	M
Diplophyllum apiculatum	2000H124	2	R	S	M
Diplophyllum apiculatum	2000M158	2	S	S	W
Diplophyllum apiculatum	2001H199	4	R	S	A
Diplophyllum apiculatum	2001H302	3	L2	S	W
Diplophyllum apiculatum	2000M138	3	R	S	W
Diplophyllum apiculatum	2001H258	3	L3	S	W
Diplophyllum apiculatum	2001H180	2	R	S	W
Diplophyllum apiculatum	2001H255	1	T	S	D
Diplophyllum apiculatum	2001H350	2	L3	S	W
Diplophyllum apiculatum	2000H122	1	R	S	M
Diplophyllum apiculatum	2000M154	3	R	S	D
Diplophyllum apiculatum	2000H118	1	R	S	W
Diplophyllum apiculatum	2000H119	1	R	S	W
Diplophyllum apiculatum	2001H187	3	R	S	W
Diplophyllum apiculatum	2001H224	2	R	S	D
Diplophyllum apiculatum	2001H191	1	R	S	W
Drapanolejunea appalachiana	2000H024	2	T	R	M
Drapanolejunea appalachiana	2001M329	3	T	S	D
Drapanolejunea appalachiana	2001H190	2	R	S	As
Drapanolejunea appalachiana	2001H260	3	T	S	D
Eurhynchium hians	2000M077	4	L3	S	D
Fissidens sp.	2001H211	4	R	S	A
Fissidens sp.	2000M021	3	R	S	M
Fissidens sp.	2001H302	4	L2	S	W
Fissidens sp.	2001H248	S	R	S	W
Fissidens appalachensis	2000M122	1	R	H	A
Fissidens appalachensis	2000M079	1	R	V	A
Fissidens appalachensis	2001M383	S	R	S	A
Fissidens appalachensis	2000M131	1	R	S	A
Fissidens appalachensis	2000M126	2	R	S	A
Fissidens appalachensis	2001H278	4	R	S	A
Fissidens appalachensis	2001H282	2	R	D	A
Fissidens appalachensis	2001M344	4	R	S	A
Fissidens appalachensis	2001M353	1	R	S	W
Fissidens appalachensis	2001H340	4	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Fissidens appalachensis	2000H077	2	R	S	A
Fissidens appalachensis	2001M372	S	R	D	S
Fissidens appalachensis	2000M048	1	R	S	W
Fissidens appalachensis	2000M069	1	R	S	A
Fissidens bryoides	2000M092	1	R	S	W
Fissidens dubius	2000M018	1	R	H	D
Fissidens dubius	2000M068	1	R	V	D
Fissidens dubius	2001M294	1	R	S	W
Fissidens dubius	2001M251	1	R	H	D
Fissidens dubius	2001M223	1	R	S	D
Fissidens dubius	2001M346	2	R	S	W
Fissidens dubius	2001M366	1	L2	S	W
Fissidens dubius	2000M045	1	R	D	D
Fissidens dubius	2001H218	2	R	S	D
Fontinalis sp.	2001H185	4	R	H	W
Fontinalis sp.	2001M383	4	R	S	A
Fontinalis sp.	2001H315	S	R	S	W
Fontinalis sp.	2001H309	4	R	S	A
Fontinalis sp.	2000M040	1	R	S	A
Fontinalis sp.	2001M235	4	R	S	W
Fontinalis dalecarlica	2001M344	1	R	S	A
Fontinalis dalecarlica	2000M118	4	R	S	A
Fontinalis dalecarlica	2001M362	1	R	S	A
Fontinalis dalecarlica	2000M145	2	R	S	A
Fontinalis dalecarlica	2001M260	1	R	S	A
Fontinalis dalecarlica	2001M384	2	R	S	A
Fontinalis dalecarlica	2001M364	1	R	S	A
Fontinalis dalecarlica	2001M390	1	R	S	A
Fontinalis dalecarlica	2001M289	1	R	S	A
Fontinalis dalecarlica	2000M129	1	R	H	A
Fontinalis dalecarlica	2001M274	1	L2	S	W
Fontinalis dalecarlica	2001M382	1	R	S	A
Frullania sp.	2000H015	3	T	S	M
Frullania asagrayana	2001M181	4	T	S	C
Frullania asagrayana	2000M024	3	L1	S	D
Frullania asagrayana	2001M329	3	T	S	D
Frullania asagrayana	2001M186	1	L2	S	D
Frullania inflata	2001H201	4	R	H	A
Frullania plana	2000H100	1	R	S	W
Frullania plana	2000H107	1	R	S	A
Frullania plana	2000M167	3	S	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Frullania plana	2001H282	3	R	D	A
Frullania plana	2001H211	3	R	S	A
Frullania plana	2000M134	4	R	S	A
Frullania plana	2001H270	2	R	S	W
Gymnocolea inflata	2001H213	3	R	S	W
Haplohymenium triste	2001M329	2	T	S	D
Harpalejunea ovata ssp. *integra*	2001H313	4	T	S	D
Harpalejunea ovata ssp. *integra*	2001M329	3	T	S	D
Harpalejunea ovata ssp. *integra*	2001H260	3	T	S	D
Harpalejunea ovata ssp. *integra*	2001H190	2	R	S	As
Harpalejunea ovata ssp. *integra*	2001H321	S	R	S	W
Harpalejunea ovata ssp. *integra*	2000H029	2	T	R	M
Harpalejunea ovata ssp. *integra*	2000M026	3	T	S	C
Harpanthus scutatus	2000H036	3	R	S	A
Harpanthus scutatus	2001H175	4	R	S	W
Herbertus aduncus ssp. *tenuis*	2001H187	3	R	S	W
Herbertus aduncus ssp. *tenuis*	2001M268	3	R	S	D
Herbertus aduncus ssp. *tenuis*	2000H021	1	R	R	M
Herbertus aduncus ssp. *tenuis*	2001M239	1	R	H	D
Herbertus aduncus ssp. *tenuis*	2000H020	3	R	R	M
Herbertus aduncus ssp. *tenuis*	2000H018	1	R	S	D
Herbertus aduncus ssp. *tenuis*	2000H032	3	R	R	D
Heterocladium macounii	2001H340	S	R	S	W
Heterocladium macounii	2000M050	4	R	S	M
Heterocladium macounii	2001M387	1	R	D	D
Heterocladium macounii	2001H175	2	R	S	W
Heterocladium macounii	2001M350	1	R	D	W
Heterocladium macounii	2001M287	1	R	S	W
Heterocladium macounii	2001M363	2	R	D	S
Heterophyllum affine	2000M020	1	L2	S	M
Hookeria acutifolia	2001H320	3	R	S	W
Hookeria acutifolia	2001H159	4	L1	H	D
Hookeria acutifolia	2000H063	3	R	S	W
Hookeria acutifolia	2001M183	1	L3	S	W
Hookeria acutifolia	2000H033	1	R	S	W
Hookeria acutifolia	2001M175	1	L3	S	D
Hookeria acutifolia	2001M174	1	L3	S	M
Hookeria acutifolia	2000H054	3	R	D	W
Hookeria acutifolia	2001H302	4	L2	S	W
Hookeria acutifolia	2000M074	1	R	V	D
Hygrohypnum sp.	2001H159	4	L1	H	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Hygrohypnum sp.	2001M228	4	R	H	W
Hygrohypnum sp.	2000H026	2	R	S	W
Hygrohypnum eugyrium	2000M027	1	R	S	A
Hygrohypnum eugyrium	2000H120	4	S	S	W
Hygrohypnum eugyrium	2000M061	1	R	H	W
Hygrohypnum eugyrium	2001H253	3	R	S	W
Hygrohypnum eugyrium	2001M314	1	R	S	W
Hygrohypnum eugyrium	2000M055	2	R	S	D
Hygrohypnum eugyrium	2000M163	2	R	S	D
Hygrohypnum eugyrium	2000M052	2	L3	S	W
Hygrohypnum eugyrium	2001M316	1	R	S	W
Hygrohypnum eugyrium	2001M286	1	R	S	W
Hygrohypnum eugyrium	2000M108	2	R	H	W
Hygrohypnum eugyrium	2001M279	1	R	S	D
Hygrohypnum eugyrium	2001M255	2	R	H	W
Hygrohypnum eugyrium	2001H274	4	R	S	W
Hygrohypnum eugyrium	2001H254	2	R	S	W
Hygrohypnum eugyrium	2000M063	1	R	H	A
Hygrohypnum eugyrium	2000M046	2	R	S	D
Hygrohypnum eugyrium	2000M104	4	R	H	W
Hygrohypnum eugyrium	2000M073	1	R	H	W
Hygrohypnum eugyrium	2001M251	3	R	H	D
Hygrohypnum eugyrium	2001H164	4	R	H	W
Hygrohypnum eugyrium	2001M347	2	R	S	W
Hygrohypnum eugyrium	2000M150	1	R	S	A
Hygrohypnum eugyrium	2001M320	3	R	S	W
Hygrohypnum eugyrium	2000M149	1	R	S	A
Hygrohypnum eugyrium	2001M221	4	R	H	D
Hygrohypnum eugyrium	2001M312	1	R	S	W
Hygrohypnum eugyrium	2001M334	3	R	D	W
Hygrohypnum eugyrium	2001M309	1	R	S	W
Hygrohypnum eugyrium	2001M392	1	R	S	D
Hygrohypnum eugyrium	2001H181	4	R	S	W
Hygrohypnum eugyrium	2001M281	4	R	S	D
Hygrohypnum eugyrium	2001M318	1	R	S	W
Hygrohypnum eugyrium	2001M234	1	R	H	D
Hygrohypnum eugyrium	2000M051	1	S	S	D
Hygrohypnum luridum	2001M244	1	R	S	W
Hygrohypnum micans	2001M250	2	R	S	M
Hygrohypnum molle	2000H076	2	R	S	A
Hygrohypnum molle	2000M127	4	R	H	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Hygrohypnum molle	2000M116	1	R	S	A
Hygrohypnum molle	2000M125	1	R	S	A
Hygrohypnum molle	2000M121	1	R	H	A
Hygrohypnum molle	2000M089	1	R	S	A
Hygrohypnum montanum	2000M119	1	R	S	A
Hygrohypnum ochraceum	2000M130	3	R	H	A
Hypnum sp.	2001M345	4	R	S	W
Hypnum sp.	2000M027	3	R	S	A
Hypnum sp.	2001M307	2	R	S	W
Hypnum sp.	2000H032	3	R	R	D
Hypnum sp.	2001H193	4	L3	S	W
Hypnum sp.	2000H114	3	R	S	W
Hypnum sp.	2001M330	3	R	S	W
Hypnum sp.	2001H252	3	R	S	W
Hypnum sp.	2001H344	4	R	D	W
Hypnum sp.	2001M191	4	R	H	W
Hypnum sp.	2001M365	4	L2	S	W
Hypnum sp.	2001M297	4	R	S	C
Hypnum curvifolium	2001M278	1	S	S	D
Hypnum curvifolium	2001M254	1	R	H	D
Hypnum curvifolium	2001M295	1	R	S	C
Hypnum curvifolium	2001M397	2	L3	H	D
Hypnum curvifolium	2001M273	1	L2	S	W
Hypnum curvifolium	2001M296	2	R	S	C
Hypnum curvifolium	2001M227	3	R	H	W
Hypnum curvifolium	2001M360	1	R	S	C
Hypnum curvifolium	2001M281	4	R	S	D
Hypnum curvifolium	2001M376	1	R	H	D
Hypnum curvifolium	2001M264	2	R	S	W
Hypnum curvifolium	2001M358	3	R	S	C
Hypnum curvifolium	2000M032	1	L1	H	M
Hypnum curvifolium	2001M332	1	R	S	D
Hypnum fertile	2001M405	3	R	D	S
Hypnum fertile	2000M031	1	L3	H	D
Hypnum fertile	2001M323	1	T	S	D
Hypnum fertile	2001H313	2	T	S	D
Hypnum fertile	2001M400	1	L3	S	D
Hypnum fertile	2001M393	3	R	D	S
Hypnum fertile	2001M370	2	R	D	S
Hypnum fertile	2001M248	4	R	S	D
Hypnum imponens	2000M156	1	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Hypnum imponens	2001M301	1	L3	S	W
Hypnum imponens	2000M057	1	R	S	D
Hypnum imponens	2000M033	1	L2	H	D
Hypnum imponens	2000M151	2	R	H	W
Hypnum imponens	2001M302	1	L3	S	W
Hypnum imponens	2001H198	4	R	S	D
Hypnum imponens	2000M166	1	R	S	D
Hypnum imponens	2001M354	2	R	S	W
Hypnum imponens	2001M175	3	L3	S	D
Hypnum imponens	2001M177	1	R	S	D
Hypnum pallescens	2001M324	1	T	S	D
Hypnum pallescens	2001M181	4	T	S	C
Hypnum pallescens	2001M375	4	R	H	D
Isopterygiopsis muelleriana	2000M050	3	R	S	M
Isopterygiopsis muelleriana	2001M380	1	R	H	D
Isopterygiopsis muelleriana	2001M287	2	R	S	W
Isopterygiopsis muelleriana	2001M378	1	R	D	S
Isopterygiopsis muelleriana	2001M294	4	R	S	W
Isopterygiopsis muelleriana	2001M396	1	R	S	W
Isopterygium sp.	2001H292	4	R	S	W
Isopterygium tenerum	2001H333	2	R	S	W
Isopterygium tenerum	2001H143	4	R	N	D
Isopterygium tenerum	2000M016	3	H	S	D
Isopterygium tenerum	2001M195	1	S	H	M
Isopterygium/ Taxifolium?	2001M301	4	L3	S	W
Jamesoniella autumnalis	2001M185	3	L2	S	D
Jamesoniella autumnalis	2001H148	3	L3	S	W
Jamesoniella autumnalis	2001H149	3	R	S	D
Jamesoniella autumnalis	2001H175	4	R	S	W
Jamesoniella autumnalis	2000H077	1	R	S	A
Jamsoniella autumnalis	2001H329	1	R	S	W
Jubula pennsylvanica	2001H284	2	R	S	W
Jubula pennsylvanica	2001H304	3	R	D	S
Jubula pennsylvanica	2001H305	4	R	S	A
Jubula pennsylvanica	2001H309	3	R	S	A
Jubula pennsylvanica	2001H201	4	R	H	A
Jubula pennsylvanica	2001H302	S	L2	S	W
Jubula pennsylvanica	2001M385	4	R	D	D
Jubula pennsylvanica	2001H303	1	R	D	S
Jubula pennsylvanica	2001M386	3	R	D	D
Jubula pennsylvanica	2000H052	2	R	V	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Jubula pennsylvanica	2001H312	2	R	S	W
Jubula pennsylvanica	2001M363	4	R	D	S
Jubula pennsylvanica	2001M212	3	R	H	W
Jubula pennsylvanica	2000H123	2	R	V	D
Jubula pennsylvanica	2001H307	1	R	S	A
Jubula pennsylvanica	2001M367	4	R	S	A
Jubula pennsylvanica	2001M331	4	R	S	W
Jubula pennsylvanica	2001M304	4	R	S	W
Jubula pennsylvanica	2001H316	1	R	S	W
Jubula pennsylvanica	2001H308	1	R	S	A
Jubula pennsylvanica	2000H108	1	R	S	W
Jubula pennsylvanica	2001H314	1	R	S	W
Jubula pennsylvanica	2001H322	1	R	S	W
Jubula pennsylvanica	2001H315	3	R	S	W
Jubula pennsylvanica	2001H179	2	R	H	W
Jubula pennsylvanica	2001H320	1	R	S	W
Jubula pennsylvanica	2000M071	2	R	H	W
Jubula pennsylvanica	2001M394	S	R	S	W
Jubula pennsylvanica	2001H236	3	R	S	A
Jubula pennsylvanica	2001M285	4	R	S	W
Jubula pennsylvanica	2001H300	3	R	H	W
Jubula pennsylvanica	2001H299	2	R	H	W
Jubula pennsylvanica	2000M167	2	S	S	W
Jubula pennsylvanica	2001H261	1	R	S	W
Jubula pennsylvanica	2001H311	3	R	D	S
Jubula pennsylvanica	2001H198	2	R	S	D
Jubula pennsylvanica	2001H256	3	T	S	D
Jubula pennsylvanica	2001H330	1	R	S	W
Jubula pennsylvanica	2001M288	3	R	S	W
Jubula pennsylvanica	2001M352	3	R	S	W
Jubula pennsylvanica	2001H160	1	R	S	W
Jubula pennsylvanica	2001H333	4	R	S	W
Jubula pennsylvanica	2001H293	2	R	S	W
Jubula pennsylvanica	2001M345	4	R	S	W
Jubula pennsylvanica	2001M354	3	R	S	W
Jubula pennsylvanica	2001M396	3	R	S	W
Jubula pennsylvanica	2001H251	4	R	S	W
Jubula pennsylvanica	2001H295	1	R	S	W
Jubula pennsylvanica	2001M305	S	R	S	W
Jubula pennsylvanica	2001H240	1	R	S	A
Jubula pennsylvanica	2001H291	4	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Jubula pennsylvanica	2001H301	4	R	H	W
Jubula pennsylvanica	2001H346	1	R	S	A
Jubula pennsylvanica	2000H129	1	R	S	W
Jubula pennsylvanica	2000H056	1	R	S	D
Jubula pennsylvanica	2001H294	1	R	S	W
Jubula pennsylvanica	2000H117	1	R	S	W
Jubula pennsylvanica	2001H175	3	R	S	W
Jubula pennsylvanica	2001H211	3	R	S	A
Jubula pennsylvanica	2001H317	1	R	S	W
Jubula pennsylvanica	2001M333	3	R	S	D
Jubula pennsylvanica	2001H273	3	R	S	W
Jubula pennsylvanica	2001H283	1	R	D	A
Jubula pennsylvanica	2001H286	1	R	S	W
Jubula pennsylvanica	2001H279	4	R	S	W
Jubula pennsylvanica	2001H334	4	R	S	W
Jubula pennsylvanica	2001H164	2	R	H	W
Jubula pennsylvanica	2001H171	2	R	S	W
Jubula pennsylvanica	2001M230	3	R	H	W
Jubula pennsylvanica	2001M320	3	R	S	W
Jubula pennsylvanica	2001H289	1	R	S	W
Jubula pennsylvanica	2000H078	1	R	H	A
Jubula pennsylvanica	2001M196	3	R	S	W
Jubula pennsylvanica	2001M348	2	R	S	W
Jubula pennsylvanica	2001H331	3	R	S	W
Jubula pennsylvanica	2001H332	3	R	S	W
Jubula pennsylvanica	2001H349	S	R	S	D
Jubula pennsylvanica	2000H125	1	R	S	W
Jubula pennsylvanica	2001H253	1	R	S	W
Jubula pennsylvanica	2001M294	4	R	S	W
Jubula pennsylvanica	2001H326	2	R	D	D
Jubula pennsylvanica	2001M369	4	R	S	D
Jubula pennsylvanica	2001H280	3	R	S	W
Jubula pennsylvanica	2001H145	3	R	S	A
Jubula pennsylvanica	2001H345	1	R	D	A
Jubula pennsylvanica	2000H028	2	R	S	W
Jubula pennsylvanica	2001H265	3	R	S	W
Jubula pennsylvanica	2001M334	4	R	D	W
Jubula pennsylvanica	2000H026	1	R	S	W
Jubula pennsylvanica	2001H206	2	R	S	A
Jubula pennsylvanica	2000H066	3	R	D	D
Jubula pennsylvanica	2001H274	2	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Jubula pennsylvanica	2001H167	4	R	H	D
Jubula pennsylvanica	2001M380	3	R	H	D
Jubula pennsylvanica	2001H281	4	R	S	W
Jubula pennsylvanica	2001M189	4	R	H	D
Jubula pennsylvanica	2000H126	1	R	S	M
Jubula pennsylvanica	2001H207	1	R	S	A
Jubula pennsylvanica	2000H084	1	R	S	A
Jubula pennsylvanica	2001H189	1	R	S	A
Jubula pennsylvanica	2000H042	3	R	V	D
Jubula pennsylvanica	2001M377	S	R	D	S
Jubula pennsylvanica	2000H027	2	R	R	M
Jubula pennsylvanica	2000M063	2	R	H	A
Jubula pennsylvanica	2001H344	1	R	D	W
Jubula pennsylvanica	2001H248	2	R	S	W
Jubula pennsylvanica	2001H343	2	R	D	W
Jubula pennsylvanica	2001M337	S	R	S	W
Jubula pennsylvanica	2001H327	1	R	S	W
Jubula pennsylvanica	2001M341	2	R	S	W
Jubula pennsylvanica	2001H292	2	R	S	W
Jubula pennsylvanica	2001H229	1	R	S	W
Jubula pennsylvanica	2001H161	3	R	S	W
Jubula pennsylvanica	2001H247	1	R	S	W
Jubula pennsylvanica	2001M346	2	R	S	W
Jubula pennsylvanica	2000H035	3	R	N	W
Jubula pennsylvanica	2000M163	2	R	S	D
Jubula pennsylvanica	2001M311	S	R	S	W
Jubula pennsylvanica	2001M407	3	R	S	W
Jubula pennsylvanica	2000M160	2	S	S	W
Jubula pennsylvanica	2001H250	1	R	S	W
Jubula pennsylvanica	2001M336	2	R	S	W
Jubula pennsylvanica	2001M315	1	R	S	W
Jubula pennsylvanica	2001H151	1	R	H	W
Jubula pennsylvanica	2001H287	3	R	S	W
Jubula pennsylvanica	2000H107	3	R	S	A
Jubula pennsylvanica	2000H070	2	R	S	D
Jubula pennsylvanica	2001M335	4	R	S	W
Jubula pennsylvanica	2001M347	3	R	S	W
Jubula pennsylvanica	2000H036	2	R	S	A
Jubula pennsylvanica	2001H150	1	R	R	A
Jubula pennsylvanica	2000H087	4	R	H	A
Jubula pennsylvanica	2001H264	2	R	D	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Jubula pennsylvanica	2001M298	4	R	S	C
Jubula pennsylvanica	2000H116	3	R	S	W
Jubula pennsylvanica	2001H177	4	R	H	D
Jubula pennsylvanica	2001H298	2	R	S	A
Jubula pennsylvanica	2001H263	3	R	D	W
Jubula pennsylvanica	2001H249	3	R	S	M
Jubula pennsylvanica	2001H266	1	R	D	W
Jubula pennsylvanica	2001H276	1	R	S	A
Jubula pennsylvanica	2001H277	1	R	S	A
Jubula pennsylvanica	2000H080	2	R	H	A
Jubula pennsylvanica	2001H213	3	R	S	W
Jubula pennsylvanica	2001H341	3	R	S	W
Jubula pennsylvanica	2001H296	3	R	S	C
Jubula pennsylvanica	2000H038	1	R	S	W
Jubula pennsylvanica	2001M350	3	R	D	W
Jungermannia sp.	2000H032	3	R	R	D
Jungermannia lanceolata	2001H205	2	R	S	A
Kurzia sylvatica	2000M158	2	S	S	W
Kurzia sylvatica	2000H122	3	R	S	M
Kurzia sylvatica	2001M245	4	R	S	W
Kurzia sylvatica	2000H124	1	R	S	M
Kurzia sylvatica	2000H127	2	R	S	M
Kurzia sylvatica	2000M162	2	S	S	D
Kurzia sylvatica	2001H192	2	S	S	W
Kurzia sylvatica	2001H321	S	R	S	W
Kurzia sylvatica	2001H327	3	R	S	W
Kurzia sylvatica	2000H118	2	R	S	W
Kurzia sylvatica	2001H180	2	R	S	W
Lejunea sp.	2000M079	3	R	V	A
Lejunea sp.	2000M026	3	T	S	C
Lejunea sp.	2001M297	4	R	S	C
Lejunea sp.	2001H295	4	R	S	W
Lejunea laetevirens	2001H202	3	R	D	D
Lejunea laetevirens	2001H260	1	T	S	D
Lejunea lamacerina	2001H200	1	R	H	D
Lejunea lamacerina	2001M236	4	R	S	A
Lejunea lamacerina	2001H174	3	R	H	D
Lejunea lamacerina	2000H066	1	R	D	D
Lejunea lamacerina	2000M166	2	R	S	D
Lejunea lamacerina	2001H218	2	R	S	D
Lejunea lamacerina	2001H171	3	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Lejunea lamacerina	2001M245	4	R	S	W
Lejunea lamacerina	2001H241	3	R	S	W
Lejunea lamacerina	2001M230	3	R	H	W
Lejunea lamacerina	2001H179	2	R	H	W
Lejunea lamacerina	2001H199	2	R	S	A
Lejunea lamacerina	2001H198	2	R	S	D
Lejunea lamacerina	2001M311	2	R	S	W
Lejunea lamacerina	2000H064	2	R	S	D
Lejunea lamacerina	2000H070	1	R	S	D
Lejunea lamacerina	2001H202	3	R	D	D
Lejunea lamacerina	2001H220	1	R	S	D
Lejunea lamacerina	2000M108	3	R	H	W
Lejunea lamacerina	2001M192	3	R	H	W
Lejunea lamacerina	2001H183	1	R	H	D
Lejunea lamacerina	2001H167	3	R	H	D
Lejunea lamacerina	2000H117	2	R	S	W
Lejunea lamacerina	2001M188	2	R	H	D
Lejunea lamacerina	2000M163	3	R	S	D
Lejunea lamacerina	2001M251	3	R	H	D
Lejunea lamacerina	2001H177	1	R	H	D
Lejunea lamacerina	2001H209	1	L2	S	W
Lejunea lamacerina	2001H208	3	L2	S	W
Lejunea lamacerina	2000H039	1	R	S	W
Lejunea lamacerina ssp. *geminata*	2000M160	3	S	S	W
Lejunea lamacerina ssp. *geminata*	2000H088	1	R	S	A
Lejunea lamacerina ssp. *geminata*	2000M159	2	R	S	W
Lejunea lamacerina ssp. *geminata*	2001M184	3	L2	S	D
Lejunea lamacerina ssp. *geminata*	2000H123	2	R	V	D
Lejunea lamacerina ssp. *geminata*	2000M168	3	R	D	D
Lejunea lamacerina ssp. *geminata*	2001H256	2	T	S	D
Lejunea lamacerina ssp. *geminata*	2001H302	4	L2	S	W
Lejunea lamacerina ssp. *geminata*	2001M377	3	R	D	S
Lejunea lamacerina ssp. *geminata*	2001M378	3	R	D	S
Lejunea lamacerina ssp. *geminata*	2000H034	3	R	D	D
Lejunea lamacerina ssp. *geminata*	2000M161	3	R	S	W
Lejunea lamacerina ssp. *geminata*	2000H087	1	R	H	A
Lejunea lamacerina ssp. *geminata*	2000H095	1	R	S	S
Lejunea lamacerina ssp. *geminata*	2001M193	3	R	H	W
Lejunea lamacerina ssp. *geminata*	2000H121	1	R	S	W
Lejunea lamacerina ssp. *geminata*	2001H303	3	R	D	S
Lejunea lamacerina ssp. *geminata*	2000M087	3	R	V	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Lejunea lamacerina ssp. *geminata*	2001H284	2	R	S	W
Lejunea ruthii	2000H019	1	T	S	M
Lejunea ruthii	2001H166	2	R	H	D
Lejunea ruthii	2000H129	4	R	S	W
Lejunea ulicina ssp. *ulicina*	2000H015	1	T	S	M
Lepidozia reptans	2000H022	1	R	R	M
Lepidozia reptans	2001H154	3	H	H	W
Lepidozia reptans	2000H034	2	R	D	D
Lepidozia reptans	2000H041	1	R	V	D
Lepidozia reptans	2000H042	1	R	V	D
Leucobryum albidum	2000H115	3	R	S	W
Leucobryum albidum	2000M137	3	R	H	C
Leucobryum albidum	2000M139	1	R	H	C
Leucobryum albidum	2000M151	1	R	H	W
Leucobryum glaucum	2001M248	4	R	S	D
Leucobryum glaucum	2001M183	2	L3	S	W
Leucodon julaceus	2000M019	1	R	R	M
Leucolejunea clypeata	2001H267	1	R	D	W
Leucolejunea clypeata	2001H254	1	R	S	W
Leucolejunea clypeata	2000H062	1	R	V	D
Leucolejunea clypeata	2001H241	1	R	S	W
Leucolejunea clypeata	2001H219	1	R	S	D
Leucolejunea clypeata	2001H199	1	R	S	A
Leucolejunea clypeata	2001H243	1	R	S	W
Leucolejunea clypeata	2001H176	1	R	H	W
Leucolejunea clypeata	2001H217	1	R	S	D
Leucolejunea clypeata	2000H030	1	R	R	M
Leucolejunea clypeata	2001H221	1	R	S	D
Leucolejunea clypeata	2001M225	4	R	H	D
Leucolejunea clypeata	2001H268	1	R	D	W
Leucolejunea clypeata	2001M281	4	R	S	D
Leucolejunea clypeata	2001H215	1	R	S	D
Leucolejunea clypeata	2000M160	3	S	S	W
Leucolejunea clypeata	2001H290	1	R	S	W
Leucolejunea clypeata	2001H222	1	R	S	D
Leucolejunea clypeata	2001H190	2	R	S	As
Leucolejunea clypeata	2001H224	1	R	S	D
Leucolejunea clypeata	2001M338	S	R	D	W
Leucolejunea clypeata	2000H020	3	R	R	M
Leucolejunea clypeata	2001H170	4	R	H	W
Leucolejunea clypeata	2001M329	2	T	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Loeskeobryum brevirostre	2001M401	1	L3	S	D
Loeskeobryum brevirostre	2001M181	1	T	S	C
Loeskeobryum brevirostre	2000M017	1	L2	S	M
Loeskeobryum brevirostre	2001H155	4	R	D	W
Loeskeobryum brevirostre	2001M402	1	L3	S	D
Loeskeobryum brevirostre	2001M173	1	S	S	D
Loeskeobryum brevirostre	2000M021	2	R	S	M
Marsupella emarginata	2001H243	2	R	S	W
Marsupella emarginata	2000H109	1	R	S	A
Marsupella emarginata	2001H178	2	R	S	W
Marsupella emarginata	2001H191	2	R	S	W
Marsupella emarginata	2001H182	2	R	S	D
Marsupella emarginata	2001M293	3	R	S	W
Marsupella emarginata	2000M070	1	R	H	W
Marsupella paroica	2001M192	4	R	H	W
Marsupella sphacelata	2001H200	2	R	H	D
Megaceros aenigmaticus	2000A011	1	L1	V	A
Megaceros aenigmaticus	2000H128	1	R	S	A
Megaceros aenigmaticus	2001A013	1	R	S	A
Megaceros aenigmaticus	2000H077	3	R	S	A
Megaceros aenigmaticus	2000M145	4	R	S	A
Megaceros aenigmaticus	2000M131	3	R	S	A
Megaceros aenigmaticus	2001H169	4	R	S	A
Megaceros aenigmaticus	2001M321	1	R	S	A
Megaceros aenigmaticus	2001M251	3	R	H	D
Megaceros aenigmaticus	2000A012	1	R	S	A
Megaceros aenigmaticus	2000M122	3	R	H	A
Megaceros aenigmaticus	2001H278	3	R	S	A
Megaceros aenigmaticus	2000A005	1	R	S	A
Megaceros aenigmaticus	2001H282	3	R	D	A
Megaceros aenigmaticus	2000H075	4	R	H	A
Megaceros aenigmaticus	2001H269	1	R	S	A
Megaceros aenigmaticus	2001H211	2	R	S	A
Metzgeria sp.	2001M346	4	R	S	W
Metzgeria conjugata	2001H291	2	R	S	W
Metzgeria conjugata	2001H292	3	R	S	W
Metzgeria conjugata	2001M294	3	R	S	W
Metzgeria conjugata	2001H157	4	R	D	W
Metzgeria conjugata	2000M023	2	R	S	D
Metzgeria conjugata	2001H341	3	R	S	W
Metzgeria conjugata	2001H326	2	R	D	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Metzgeria conjugata	2001H202	1	R	D	D
Metzgeria furcata	2000H019	3	T	S	M
Metzgeria furcata	2001H223	1	R	S	D
Metzgeria furcata	2000M019	3	R	R	M
Metzgeria furcata	2001H227	1	R	S	W
Metzgeria furcata	2001H202	2	R	D	D
Metzgeria leptoneura	2001H333	2	R	S	W
Metzgeria leptoneura	2000H035	1	R	N	W
Metzgeria leptoneura	2001H245	4	R	S	W
Metzgeria leptoneura	2001H332	4	R	S	W
Metzgeria leptoneura	2001M396	3	R	S	W
Metzgeria leptoneura	2001H338	4	L3	H	D
Metzgeria leptoneura	2001H175	2	R	S	W
Metzgeria leptoneura	2001M287	2	R	S	W
Metzgeria leptoneura	2001H301	4	R	H	W
Metzgeria leptoneura	2001H264	3	R	D	W
Metzgeria leptoneura	2000H033	3	R	S	W
Metzgeria leptoneura	2001H171	1	R	S	W
Mnium hornum	2000M168	1	R	D	D
Mnium hornum	2000M155	1	R	S	D
Mnium hornum	2001M257	1	R	H	W
Mnium hornum	2001M248	3	R	S	D
Mnium hornum	2001M185	4	L2	S	D
Mnium hornum	2000H106	3	R	S	D
Mnium hornum	2001M370	4	R	D	S
Mnium hornum	2001M181	4	T	S	C
Mnium hornum	2001M242	3	R	S	D
Mnium hornum	2001H252	2	R	S	W
Mnium hornum	2001M230	4	R	H	W
Mnium hornum	2001H285	4	T	S	D
Mnium hornum	2001M204	1	H	H	D
Mnium hornum	2000M162	4	S	S	D
Mnium hornum	2000M156	2	R	S	W
Mnium hornum	2000M109	1	S	S	D
Mnium hornum	2001H158	4	H	H	W
Mnium hornum	2001H314	S	R	S	W
Mnium hornum	2001M306	1	R	S	W
Mnium hornum	2001M315	2	R	S	W
Mnium hornum	2001H342	4	R	D	W
Mnium hornum	2001M175	4	L3	S	D
Mnium hornum	2001M288	1	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Mnium hornum	2000M142	3	R	S	D
Mnium hornum	2001H142	3	S	S	D
Mnium hornum	2001M327	1	T	S	D
Mnium hornum	2001M178	1	R	S	D
Mnium hornum	2001H187	2	R	S	W
Mnium hornum	2000H110	2	R	S	W
Mnium hornum	2001M406	S	R	S	D
Mnium hornum	2001M391	2	R	S	W
Mnium hornum	2001M209	2	R	D	W
Mnium hornum	2000M139	3	R	H	C
Mnium hornum	2000M082	1	R	S	W
Mnium hornum	2001M174	3	L3	S	M
Mnium hornum	2000M053	1	S	S	W
Mnium hornum	2001H155	2	R	D	W
Mnium hornum	2001H304	4	R	D	S
Mnium hornum	2001H303	S	R	D	S
Mnium hornum	2001H154	2	H	H	W
Mnium hornum	2000M154	1	R	S	D
Mnium hornum	2001H271	2	R	S	A
Mnium hornum	2001M385	3	R	D	D
Mnium hornum	2001H147	3	S	S	D
Mnium hornum	2000H127	3	R	S	M
Mnium hornum	2001M310	1	R	S	W
Mnium hornum	2000H124	2	R	S	M
Mnium hornum	2001M201	3	H	S	M
Mnium hornum	2001M365	S	L2	S	W
Mnium hornum	2001H152	3	H	S	M
Mnium hornum	2000M120	1	R	S	A
Mnium hornum	2001M298	4	R	S	C
Mnium hornum	2001H264	4	R	D	W
Mnium hornum	2000M013	1	R	S	M
Mnium hornum	2000H099	2	R	S	A
Mnium hornum	2001H275	3	R	S	W
Mnium hornum	2001M206	4	S	H	D
Mnium hornum	2001M340	1	R	D	W
Mnium hornum	2001M250	4	R	S	M
Mnium hornum	2001M266	1	H	H	D
Mnium hornum	2001M300	1	L3	S	W
Mnium hornum	2001M291	1	R	S	W
Mnium thomsonii	2000H096	2	R/H	R	M
Mnium thomsonii	2000H123	4	R	V	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Mnium thomsonii	2000M025	1	R	S	M
Nardia lescurii	2001H201	3	R	H	A
Neckera pennata	2000M026	1	T	S	C
Nowellia curvifolia	2001H259	1	L3	S	W
Nowellia curvifolia	2001M274	3	L2	S	W
Nowellia curvifolia	2001H348	S	L3	S	D
Nowellia curvifolia	2001H148	2	L3	S	W
Nowellia curvifolia	2001H337	1	L3	H	D
Nowellia curvifolia	2000H023	1	L2	H	M
Nowellia curvifolia	2000H051	1	L2	H	D
Nowellia curvifolia	2001H338	1	L3	H	D
Nowellia curvifolia	2001H347	4	L3	S	D
Nowellia curvifolia	2001H258	3	L3	S	W
Odontoschisma denudatum	2001H210	1	R	S	A
Odontoschisma prostratum	2001H168	1	R	S	A
Odontoschisma prostratum	2000M162	2	S	S	D
Odontoschisma prostratum	2000H127	2	R	S	M
Oncophorus rauii	2001M249	1	R	S	D
Oncophorus rauii	2000M146	1	R	H	D
Oncophorus rauii	2001H182	2	R	S	D
Oncophorus rauii	2000M144	3	R	H	D
Oxystegus tenuirostris	2001M206	1	S	H	D
Oxystegus tenuirostris	2001M345	3	R	S	W
Oxystegus tenuirostris	2000M028	1	R	S	M
Oxystegus tenuirostris	2001M346	4	R	S	W
Oxystegus tenuirostris	2001H175	3	R	S	W
Oxystegus tenuirostris	2001M363	1	R	D	S
Pallavacinia lyellii	2001H141	1	S	S	M
Pellia sp.	2000M080	3	S	S	W
Pellia sp.	2000H105	1	R	S	W
Pellia appalachiana	2001H159	1	L1	H	D
Pellia epiphylla	2001H279	1	R	S	W
Pellia epiphylla	2000H114	1	R	S	W
Pellia epiphylla	2001H301	1	R	H	W
Pellia epiphylla	2001H225	1	R	S	W
Pellia epiphylla	2001H275	1	R	S	W
Pellia epiphylla	2001H231	1	R	S	W
Pellia epiphylla	2001H153	1	H	H	D
Pellia epiphylla	2001H152	1	H	S	M
Pellia epiphylla	2000H113	1	R	S	W
Pellia epiphylla	2001H158	1	H	H	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Pellia epiphylla	2000M080	2	S	S	W
Pellia epiphylla	2000H058	1	R	S	D
Pellia epiphylla	2001H281	3	R	S	W
Pellia epiphylla	2001M209	2	R	D	W
Pellia epiphylla	2001H271	1	R	S	A
Pellia epiphylla	2001H157	1	R	D	W
Pellia epiphylla	2000H096	1	R/H	R	M
Pellia epiphylla	2000M035	2	R	H	A
Pellia epiphylla	2001M198	4	R	S	W
Pellia epiphylla	2001H242	1	R	S	W
Pellia epiphylla	2000H054	1	R	D	W
Pellia epiphylla	2000H033	1	R	S	W
Pellia epiphylla	2001H187	1	R	S	W
Pellia epiphylla	2001H232	1	R	S	W
Pellia epiphylla	2001H154	1	H	H	W
Pellia epiphylla	2000H028	1	R	S	W
Philonotis capillaris	2000M130	3	R	H	A
Philonotis fontana	2000M107	1	R	S	W
Philonotis fontana	2000M115	2	R	H	W
Philonotis fontana	2000M099	1	R	S	W
Philonotis fontana	2001M271	1	R	S	D
Philonotis fontana	2001H198	4	R	S	D
Philonotis fontana	2001M217	1	H	H	W
Philonotis fontana	2000M168	2	R	D	D
Philonotis fontana	2001M257	3	R	H	W
Philonotis fontana	2000M097	1	R	H	W
Philonotis fontana	2000M088	1	R	V	D
Philonotis fontana	2001M227	1	R	H	W
Philonotis fontana	2001M235	1	R	S	W
Philonotis fontana	2001H169	3	R	S	A
Philonotis fontana	2000M071	1	R	H	W
Philonotis fontana	2000M127	1	R	H	A
Philonotis fontana	2000M098	1	R	D	W
Philonotis fontana	2001M259	1	R	H	W
Philonotis fontana	2000M085	3	R	S	A
Philonotis fontana	2001H275	4	R	S	W
Philonotis fontana	2000M108	1	R	H	W
Philonotis fontana	2000M100	1	R	H	D
Philonotis fontana	2001M233	3	R	S	W
Philonotis fontana	2001H158	4	H	H	W
Philonotis fontana	2000H085	3	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Philonotis fontana	2001M196	2	R	S	W
Philonotis fontana	2001M294	4	R	S	W
Philonotis fontana	2001H187	3	R	S	W
Philonotis fontana	2001M258	1	R	H	W
Plagiochila caduciloba	2000H020	1	R	R	M
Plagiochila caduciloba	2000H030	1	R	R	M
Plagiochila europhyllon ssp. *echinata*	2000M021	2	R	S	M
Plagiochila europhyllon ssp. *echinata*	2000H046	2	R	V	D
Plagiochila europhyllon ssp. *echinata*	2000H042	3	R	V	D
Plagiochila europhyllon ssp. *echinata*	2000M065	3	R	D	D
Plagiochila europhyllon ssp. *echinata*	2000M066	2	R	V	D
Plagiochila europhyllon ssp. *echinata*	2000M050	2	R	S	M
Plagiochila europhyllon ssp. *echinata*	2000H016	1	R	S	M
Plagiochila porelloides	2000M027	3	R	S	A
Plagiochila porelloides	2001H213	2	R	S	W
Plagiochila porelloides	2000H026	3	R	S	W
Plagiochila porelloides	2000M167	3	S	S	W
Plagiochila porelloides	2001H313	3	T	S	D
Plagiochila porelloides	2000H027	1	R	R	M
Plagiochila porelloides	2001M294	4	R	S	W
Plagiochila porelloides	2001H218	1	R	S	D
Plagiochila porelloides	2001M380	3	R	H	D
Plagiochila porelloides	2001H206	2	R	S	A
Plagiochila porelloides	2001H336	1	L3	H	D
Plagiochila porelloides	2000M071	3	R	H	W
Plagiochila porelloides	2000M061	3	R	H	W
Plagiochila porelloides	2001H289	4	R	S	W
Plagiochila porelloides	2001H327	2	R	S	W
Plagiochila porelloides	2000M108	3	R	H	W
Plagiochila porelloides	2001H229	3	R	S	W
Plagiochila porelloides	2001H288	1	R	S	W
Plagiochila porelloides	2001H173	1	R	H	W
Plagiochila porelloides	2001H286	3	R	S	W
Plagiochila porelloides	2001H293	2	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Plagiochila porelloides	2001H205	2	R	S	A
Plagiochila porelloides	2000H044	1	R	S	W
Plagiochila porelloides	2000M097	3	R	H	W
Plagiochila porelloides	2001H331	1	R	S	W
Plagiochila porelloides	2001H185	1	R	H	W
Plagiochila porelloides	2001M341	4	R	S	W
Plagiochila porelloides	2001H158	4	H	H	W
Plagiochila porelloides	2001H169	1	R	S	A
Plagiochila porelloides	2001H333	4	R	S	W
Plagiochila porelloides	2001H214	2	R	S	W
Plagiochila porelloides	2001H332	3	R	S	W
Plagiochila porelloides	2001H172	1	R	H	D
Plagiochila porelloides	2001H339	3	R	S	W
Plagiochila porelloides	2001H268	4	R	D	W
Plagiochila porelloides	2001H297	3	R	S	A
Plagiochila porelloides	2001M286	4	R	S	W
Plagiochila porelloides	2001H242	2	R	S	W
Plagiochila porelloides	2001H161	3	R	S	W
Plagiochila porelloides	2001H301	4	R	H	W
Plagiochila porelloides	2001H300	2	R	H	W
Plagiochila porelloides	2001H175	4	R	S	W
Plagiochila porelloides	2001H170	1	R	H	W
Plagiochila porelloides	2001H298	2	R	S	A
Plagiochila porelloides	2001M384	4	R	S	A
Plagiochila porelloides	2001H251	1	R	S	W
Plagiochila porelloides	2000H075	2	R	H	A
Plagiochila porelloides	2001H322	3	R	S	W
Plagiochila porelloides	2001H211	4	R	S	A
Plagiochila porelloides	2001M331	4	R	S	W
Plagiochila porelloides	2001H249	3	R	S	M
Plagiochila porelloides	2001M364	3	R	S	A
Plagiochila porelloides	2001H279	3	R	S	W
Plagiochila porelloides	2001H227	3	R	S	W
Plagiochila porelloides	2000M073	2	R	H	W
Plagiochila porelloides	2001M390	3	R	S	A
Plagiochila porelloides	2001H216	1	R	S	D
Plagiochila porelloides	2001H167	1	R	H	D
Plagiochila porelloides	2001H291	4	R	S	W
Plagiochila porelloides	2001H302	S	L2	S	W
Plagiochila porelloides	2001M362	4	R	S	A
Plagiochila porelloides	2001H324	2	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Plagiochila porelloides	2001M405	S	R	D	S
Plagiochila porelloides	2001M240	3	R	H	D
Plagiochila porelloides	2001H228	2	R	S	W
Plagiochila porelloides	2001H287	2	R	S	W
Plagiochila porelloides	2001M367	4	R	S	A
Plagiochila porelloides	2001H222	4	R	S	D
Plagiochila porelloides	2001H265	3	R	S	W
Plagiochila porelloides	2000H045	1	R	S	W
Plagiochila porelloides	2001H236	1	R	S	A
Plagiochila porelloides	2001M194	1	R	S	W
Plagiochila porelloides	2000H046	2	R	V	D
Plagiochila porelloides	2001H238	2	R	S	A
Plagiochila porelloides	2001H248	2	R	S	W
Plagiochila porelloides	2000H116	1	R	S	W
Plagiochila porelloides	2000M160	2	S	S	W
Plagiochila porelloides	2001H315	1	R	S	W
Plagiochila porelloides	2000M063	3	R	H	A
Plagiochila porelloides	2001H275	3	R	S	W
Plagiochila porelloides	2001H299	2	R	H	W
Plagiochila porelloides	2001M224	4	R	H	D
Plagiochila porelloides	2001M311	S	R	S	W
Plagiochila porelloides	2001H201	2	R	H	A
Plagiochila porelloides	2000H035	3	R	N	W
Plagiochila porelloides	2001H165	3	R	S	W
Plagiochila porelloides	2001H277	S	R	S	A
Plagiochila porelloides	2000H049	3	R	H	W
Plagiochila porelloides	2001H274	4	R	S	W
Plagiochila porelloides	2001M192	3	R	H	W
Plagiochila porelloides	2000H117	2	R	S	W
Plagiochila porelloides	2000M088	2	R	V	D
Plagiochila porelloides	2000M164	2	R	S	W
Plagiochila porelloides	2001M346	3	R	S	W
Plagiochila porelloides	2000H036	3	R	S	A
Plagiochila porelloides	2001M348	4	R	S	W
Plagiochila porelloides	2001H155	3	R	D	W
Plagiochila porelloides	2000H082	1	R	S	A
Plagiochila porelloides	2001M354	3	R	S	W
Plagiochila porelloides	2001M347	4	R	S	W
Plagiochila porelloides	2001M356	3	R	S	C
Plagiochila porelloides	2000H056	3	R	S	D
Plagiochila porelloides	2000H036	1	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Plagiochila porelloides	2001M383	3	R	S	A
Plagiochila porelloides	2001H166	4	R	H	D
Plagiochila porelloides	2001H281	2	R	S	W
Plagiochila porelloides	2001H261	2	R	S	W
Plagiochila porelloides	2001H273	3	R	S	W
Plagiochila porelloides	2001M371	3	R	S	W
Plagiochila porelloides	2001H179	1	R	H	W
Plagiochila porelloides	2001H314	3	R	S	W
Plagiochila porelloides	2001H246	1	R	S	W
Plagiochila porelloides	2001H186	1	R	H	W
Plagiochila porelloides	2001H311	2	R	D	S
Plagiochila porelloides	2001H262	1	R	S	W
Plagiochila porelloides	2001H296	3	R	S	C
Plagiochila porelloides	2000H129	4	R	S	W
Plagiochila porelloides	2001H230	1	R	S	W
Plagiochila porelloides	2001H164	2	R	H	W
Plagiochila porelloides	2001H303	4	R	D	S
Plagiochila porelloides	2001H305	2	R	S	A
Plagiochila porelloides	2001M304	4	R	S	W
Plagiochila porelloides	2001H304	1	R	D	S
Plagiochila porelloides	2000M163	2	R	S	D
Plagiochila porelloides	2001H317	3	R	S	W
Plagiochila porelloides	2001M330	3	R	S	W
Plagiochila porelloides	2001H330	2	R	S	W
Plagiochila porelloides	2001H226	2	R	S	W
Plagiochila porelloides	2001H240	3	R	S	A
Plagiochila porelloides	2001H280	1	R	S	W
Plagiochila porelloides	2001H198	3	R	S	D
Plagiochila porelloides	2001H184	1	R	H	W
Plagiochila porelloides	2001H231	3	R	S	W
Plagiochila porelloides	2001M301	4	L3	S	W
Plagiochila porelloides	2001H174	3	R	H	D
Plagiochila porelloides	2001H344	4	R	D	W
Plagiochila porelloides	2000H071	2	R	S	W
Plagiochila porelloides	2000H055	1	R	S	D
Plagiochila porelloides	2001H343	3	R	D	W
Plagiochila porelloides	2000H120	1	S	S	W
Plagiochila sullivantii	2000H042	2	R	V	D
Plagiochila sullivantii	2000M028	3	R	S	M
Plagiochila virginica	2001M385	3	R	D	D
Plagiomnium ciliare	2001M325	1	T	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Plagiomnium ciliare	2001M306	2	R	S	W
Plagiomnium ciliare	2001M174	3	L3	S	M
Plagiomnium ciliare	2000M080	1	S	S	W
Plagiomnium ciliare	2001M213	1	S	S	M
Plagiomnium ciliare	2001M368	2	R	D	S
Plagiomnium ciliare	2001H266	4	R	D	W
Plagiomnium ciliare	2000H068	3	R	V	D
Plagiomnium ciliare	2001H271	3	R	S	A
Plagiomnium ciliare	2000H054	3	R	D	W
Plagiomnium ciliare	2000M062	1	S	S	W
Plagiomnium ciliare	2000H071	3	R	S	W
Plagiomnium ciliare	2001H142	3	S	S	D
Plagiomnium ciliare	2000M014	1	R	S	M
Plagiomnium ciliare	2001M197	3	S	H	M
Plagiomnium ciliare	2001M223	S	R	S	D
Plagiomnium ciliare	2000M029	3	R	S	M
Plagiomnium ciliare	2001H285	3	T	S	D
Plagiomnium ciliare	2000M088	3	R	V	D
Plagiomnium ciliare	2001M205	1	S	H	M
Plagiomnium ciliare	2001M207	4	R	D	W
Plagiothecium sp.	2001H155	4	R	D	W
Plagiothecium sp.	2001H326	4	R	D	D
Plagiothecium cavifolium	2000M074	2	R	V	D
Plagiothecium cavifolium	2000M075	1	R	V	W
Plagiothecium cavifolium	2001H264	3	R	D	W
Plagiothecium cavifolium	2001M197	1	S	H	M
Plagiothecium cavifolium	2000M049	1	R	S	D
Plagiothecium cavifolium	2001M200	1	S	H	M
Plagiothecium denticulatum	2001M250	2	R	S	M
Plagiothecium denticulatum	2000M028	3	R	S	M
Plagiothecium denticulatum	2000M029	1	R	S	M
Plagiothecium denticulatum	2000H033	3	R	S	W
Plagiothecium denticulatum	2000M038	1	L3	H	D
Plagiothecium laetum	2001H153	3	H	H	D
Plagiothecium laetum	2001H157	3	R	D	W
Plagiothecium laetum	2001M369	4	R	S	D
Plagiothecium laetum	2001M209	3	R	D	W
Plagiothecium laetum	2000M041	3	H	S	D
Plagiothecium laetum	2001M208	1	R	D	W
Plagiothecium laetum	2001M385	1	R	D	D
Plagiothecium laetum	2001H152	3	H	S	M

Taxa	Number	Proportion	Substrate	Light	Moisture
Plagiothecium laetum	2001M199	3	S	H	M
Plagiothecium laetum	2000M096	1	R	S	D
Plagiothecium laetum	2001M370	1	R	D	S
Plagiothecium laetum	2001M346	3	R	S	W
Plagiothecium laetum	2001H285	4	T	S	D
Platyhypnidium riparioides	2000M135	1	R	S	A
Platyhypnidium riparioides	2001M229	1	R	S	A
Platyhypnidium riparioides	2001M349	1	R	S	A
Platyhypnidium riparioides	2001M333	1	R	S	D
Platyhypnidium riparioides	2000M164	1	R	S	W
Platyhypnidium riparioides	2001M351	1	R	S	W
Platyhypnidium riparioides	2001H293	4	R	S	W
Platyhypnidium riparioides	2001H287	4	R	S	W
Platyhypnidium riparioides	2001M290	1	R	S	A
Platyhypnidium riparioides	2000M118	1	R	S	A
Platyhypnidium riparioides	2001M371	2	R	S	W
Platyhypnidium riparioides	2000M129	1	R	H	A
Platyhypnidium riparioides	2001M352	3	R	S	W
Platyhypnidium riparioides	2001H341	3	R	S	W
Platyhypnidium riparioides	2000M132	1	R	S	A
Platyhypnidium riparioides	2001M388	3	R	S	W
Platyhypnidium riparioides	2001M399	1	R	D	W
Platyhypnidium riparioides	2001M357	1	R	S	C
Platyhypnidium riparioides	2001M394	1	R	S	W
Platyhypnidium riparioides	2001H295	4	R	S	W
Platyhypnidium riparioides	2001M236	4	R	S	A
Platyhypnidium riparioides	2000M058	1	S	S	D
Platyhypnidium riparioides	2000M078	1	R	D	A
Platyhypnidium riparioides	2001H296	3	R	S	C
Platyhypnidium riparioides	2001M189	2	R	H	D
Platyhypnidium riparioides	2001H312	4	R	S	W
Platyhypnidium riparioides	2001M395	1	R	S	W
Platyhypnidium riparioides	2001H344	3	R	D	W
Platyhypnidium riparioides	2000M117	1	R	H	A
Platyhypnidium riparioides	2001H343	2	R	D	W
Platyhypnidium riparioides	2001M359	1	R	S	C
Platyhypnidium riparioides	2000H085	3	R	S	A
Platyhypnidium riparioides	2001H276	3	R	S	A
Platyhypnidium riparioides	2000M101.1	1	R	D	A
Platylomella lescurii	2001M389	1	R	S	A
Platylomella lescurii	2001H204	2	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Platylomella lescurii	2001H283	3	R	D	A
Platylomella lescurii	2001M229	4	R	S	A
Platylomella lescurii	2001M196	3	R	S	W
Platylomella lescurii	2001H274	4	R	S	W
Platylomella lescurii	2001H336	3	L3	H	D
Platylomella lescurii	2001H328	2	R	S	A
Platylomella lescurii	2000M145	2	R	S	A
Platylomella lescurii	2001H211	4	R	S	A
Platylomella lescurii	2001H249	3	R	S	M
Platylomella lescurii	2001H319	3	R	S	A
Platylomella lescurii	2001M383	1	R	S	A
Platylomella lescurii	2000M102	2	R	S	W
Platylomella lescurii	2000H083	2	R	S	A
Platylomella lescurii	2000M120	3	R	S	A
Platylomella lescurii	2001H237	4	R	S	A
Platylomella lescurii	2000H079	3	R	S	A
Platylomella lescurii	2001H214	3	R	S	W
Platylomella lescurii	2000M133	1	R	S	A
Platylomella lescurii	2001M202	3	H	H	W
Platylomella lescurii	2000H082	3	R	S	A
Platylomella lescurii	2001M279	4	R	S	D
Platylomella lescurii	2000M047	3	R	S	D
Platylomella lescurii	2001M269	1	R	S	A
Platylomella lescurii	2001M261	1	R	S	A
Platylomella lescurii	2001M395	2	R	S	W
Platylomella lescurii	2001H186	3	R	H	W
Platylomella lescurii	2001M299	2	R	S	W
Platylomella lescurii	2001M388	1	R	S	W
Platylomella lescurii	2000M104	1	R	H	W
Platylomella lescurii	2001H261	4	R	S	W
Platylomella lescurii	2001H295	4	R	S	W
Platylomella lescurii	2000M113	1	R	H	W
Platylomella lescurii	2000M126	2	R	S	A
Platylomella lescurii	2001H269	3	R	S	A
Platylomella lescurii	2001M304	2	R	S	W
Platylomella lescurii	2001H201	3	R	H	A
Platylomella lescurii	2000M131	3	R	S	A
Platylomella lescurii	2000M054	1	R	S	W
Platylomella lescurii	2001H324	3	R	S	A
Platylomella lescurii	2000M167	1	S	S	W
Platylomella lescurii	2001M384	2	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Platylomella lescurii	2001H291	2	R	S	W
Platylomella lescurii	2001H203	4	R	H	A
Platylomella lescurii	2001M348	3	R	S	W
Polytrichum pallidisetum	2000M148	1	R	S	W
Polytrichum pallidisetum	2000M137	2	R	H	C
Polytrichum pallidisetum	2000M041	1	H	S	D
Polytrichum pallidisetum	2000M144	1	R	H	D
Polytrichum pallidisetum	2001M204	3	H	H	D
Polytrichum pallidisetum	2000M141	1	R	S	D
Porella pinnata	2001H334	1	R	S	W
Porella pinnata	2000H017	1	R	S	A
Porella pinnata	2001H145	1	R	S	A
Porella pinnata	2001H237	1	R	S	A
Porella pinnata	2001H196	1	R	S	A
Porella pinnata	2001H163	1	R	S	A
Porella pinnata	2001H239	1	R	S	A
Porella pinnata	2001H341	3	R	S	W
Porella pinnata	2001H188	1	R	H	W
Porella pinnata	2001H325	1	R	S	A
Porella pinnata	2001H233	1	R	S	W
Porella pinnata	2001M382	S	R	S	A
Porella pinnata	2001H195	1	R	S	A
Porella pinnata	2001H324	2	R	S	A
Porella pinnata	2001H235	2	R	S	A
Porella pinnata	2001H352	1	R	S	W
Porella pinnata	2001H303	2	R	D	S
Porella pinnata	2000H037	1	R	S	W
Porella pinnata	2001H306	1	R	S	A
Porella pinnata	2001H335	1	L3	H	D
Porella pinnata	2001H174	2	R	H	D
Porella pinnata	2001M384	3	R	S	A
Porella pinnata	2001H305	4	R	S	A
Porella pinnata	2001H278	1	R	S	A
Porella pinnata	2001M299	3	R	S	W
Porella pinnata	2001H339	1	R	S	W
Porella pinnata	2000M021	3	R	S	M
Porella pinnata	2001H297	3	R	S	A
Porella pinnata	2001H279	4	R	S	W
Porella pinnata	2001M407	2	R	S	W
Porella pinnata	2001H308	4	R	S	A
Porella pinnata	2001M349	4	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Porella pinnata	2001H340	1	R	S	W
Porella pinnata	2001H345	3	R	D	A
Porella pinnata	2001H189	3	R	S	A
Porella pinnata	2001H197	1	R	S	A
Porella pinnata	2001H269	3	R	S	A
Porella pinnata	2001H273	1	R	S	W
Porella platyphylloidea	2000M024	3	L1	S	D
Porella wataugensis	2001H328	2	R	S	A
Porella wataugensis	2000H071	3	R	S	W
Porella wataugensis	2001H270	1	R	S	W
Pseudotaxiphyllum distichaceum	2001M262	2	H	S	D
Pseudotaxiphyllum elegans	2001H175	3	R	S	W
Pseudotaxiphyllum elegans	2001M306	4	R	S	W
Pseudotaxiphyllum elegans	2000M142	2	R	S	D
Pseudotaxiphyllum elegans	2000M154	3	R	S	D
Pseudotaxiphyllum elegans	2000H102	2	R	S	A
Pseudotaxiphyllum elegans	2001H302	3	L2	S	W
Pseudotaxiphyllum elegans	2000M156	4	R	S	W
Pseudotaxiphyllum elegans	2001M241	3	R	S	D
Pseudotaxiphyllum elegans	2001M245	3	R	S	W
Pseudotaxiphyllum elegans	2001H141	2	S	S	M
Pseudotaxiphyllum elegans	2000M028	3	R	S	M
Pseudotaxiphyllum elegans	2001H149	3	R	S	D
Pseudotaxiphyllum elegans	2001M242	1	R	S	D
Pseudotaxiphyllum elegans	2001M243	1	R	S	D
Pseudotaxiphyllum elegans	2001M247	1	R	S	D
Pseudotaxiphyllum elegans	2001M268	4	R	S	D
Pseudotaxiphyllum elegans	2001H303	4	R	D	S
Pseudotaxiphyllum elegans	2000H123	3	R	V	D
Pseudotaxiphyllum elegans	2001M262	3	H	S	D
Pseudotaxiphyllum elegans	2001M230	3	R	H	W
Pseudotaxiphyllum elegans	2001H262	3	R	S	W
Pseudotaxiphyllum elegans	2000M155	3	R	S	D
Pylaisiadelpha tenuirostris	2000M039	1	R	H	M
Pylaisiadelpha tenuirostris	2000M030	1	L3	H	D
Pylaisiadelpha tenuirostris	2001M336	1	R	S	W
Pylaisiadelpha tenuirostris	2001M268	1	R	S	D
Racomitrium aciculare	2001M319	4	R	S	W
Racomitrium aciculare	2001H262	2	R	S	W
Racomitrium aciculare	2001M214	1	R	H	W
Racomitrium aciculare	2001M277	1	R	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Racomitrium aciculare	2001M255	2	R	H	W
Racomitrium aciculare	2001M309	4	R	S	W
Racomitrium aciculare	2001M221	1	R	H	D
Racomitrium aciculare	2001M220	1	R	H	W
Racomitrium aciculare	2001M286	4	R	S	W
Racomitrium aciculare	2001M228	1	R	H	W
Racomitrium aciculare	2000M046	1	R	S	D
Racomitrium aciculare	2001M284	1	R	S	D
Racomitrium aciculare	2001M281	2	R	S	D
Racomitrium aciculare	2001M234	3	R	H	D
Racomitrium aciculare	2000M114	1	R	S	W
Racomitrium aciculare	2001M374	1	R	S	C
Racomitrium aciculare	2001M282	2	R	S	D
Racomitrium aciculare	2001M279	3	R	S	D
Racomitrium aciculare	2001M346	4	R	S	W
Radula sp.	2000M159	S	R	S	W
Radula sp.	2000H020	2	R	R	M
Radula sp.	2000H071	3	R	S	W
Radula obconica	2001H321	1	R	S	W
Radula obconica	2001H260	3	T	S	D
Radula obconica	2000H024	1	T	R	M
Radula obconica	2001H256	2	T	S	D
Radula obconica	2001H277	2	R	S	A
Radula obconica	2001M188	3	R	H	D
Radula obconica	2001M189	3	R	H	D
Radula obconica	2000H121	3	R	S	W
Radula obconica	2000H126	3	R	S	M
Radula obconica	2000M019	3	R	R	M
Radula obconica	2001H166	1	R	H	D
Radula sullivantii	2000H056	2	R	S	D
Radula sullivantii	2000M160	3	S	S	W
Radula sullivantii	2000H121	2	R	S	W
Radula sullivantii	2000H058	3	R	S	D
Radula sullivantii	2001H241	3	R	S	W
Radula tenax	2001M372	3	R	D	S
Radula tenax	2001M212	2	R	H	W
Radula tenax	2001H309	4	R	S	A
Radula tenax	2000H029	1	T	R	M
Radula tenax	2001M287	3	R	S	W
Radula tenax	2000M065	3	R	D	D
Radula tenax	2001H172	3	R	H	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Radula tenax	2001H310	1	T	S	D
Radula tenax	2001M293	4	R	S	W
Radula tenax	2001H313	3	T	S	D
Radula tenax	2000H021	2	R	R	M
Radula tenax	2001H335	4	L3	H	D
Rhizomnium appalachianum	2001M404	2	L3	S	D
Rhizomnium appalachianum	2000H083	3	R	S	A
Rhizomnium appalachianum	2001M371	2	R	S	W
Rhizomnium appalachianum	2001M391	2	R	S	W
Rhizomnium appalachianum	2001H174	3	R	H	D
Rhizomnium appalachianum	2001M251	3	R	H	D
Rhizomnium appalachianum	2001M207	3	R	D	W
Rhizomnium appalachianum	2001M407	2	R	S	W
Rhizomnium appalachianum	2001M403	4	L3	S	D
Rhizomnium appalachianum	2000M111	1	R	V	W
Rhizomnium appalachianum	2001M361	1	R	S	W
Rhizomnium appalachianum	2001H225	4	R	S	W
Rhizomnium appalachianum	2001H185	2	R	H	W
Rhizomnium appalachianum	2001M322	1	H	S	W
Rhizomnium appalachianum	2000M119	3	R	S	A
Rhizomnium appalachianum	2001M351	S	R	S	W
Rhizomnium appalachianum	2000M012	1	S	S	W
Rhizomnium appalachianum	2001H201	3	R	H	A
Rhizomnium appalachianum	2001M246	1	R	S	W
Rhizomnium appalachianum	2001M392	2	R	S	D
Rhizomnium appalachianum	2001M230	1	R	H	W
Rhizomnium appalachianum	2001M345	2	R	S	W
Rhizomnium appalachianum	2001H303	S	R	D	S
Rhizomnium appalachianum	2001M213	2	S	S	M
Rhizomnium appalachianum	2001H142	2	S	S	D
Rhizomnium appalachianum	2000M086	1	R	S	W
Rhizomnium appalachianum	2001M365	1	L2	S	W
Rhizomnium punctatum	2000M097	3	R	H	W
Rhizomnium punctatum	2001H302	4	L2	S	W
Rhizomnium punctatum	2001M333	2	R	S	D
Rhizomnium punctatum	2001H265	1	R	S	W
Rhizomnium punctatum	2000H100	3	R	S	W
Rhizomnium punctatum	2001M304	1	R	S	W
Rhizomnium punctatum	2001H331	S	R	S	W
Rhizomnium punctatum	2001H240	4	R	S	A
Rhizomnium punctatum	2001M236	1	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Rhizomnium punctatum	2001H314	S	R	S	W
Rhizomnium punctatum	2001H261	4	R	S	W
Rhizomnium punctatum	2001M206	4	S	H	D
Rhizomnium punctatum	2001H301	4	R	H	W
Rhizomnium punctatum	2001M233	2	R	S	W
Rhizomnium punctatum	2001M299	2	R	S	W
Rhizomnium punctatum	2001H315	S	R	S	W
Rhizomnium punctatum	2000M107	3	R	S	W
Rhizomnium punctatum	2001H280	3	R	S	W
Rhizomnium punctatum	2001H286	3	R	S	W
Rhizomnium punctatum	2001H251	4	R	S	W
Rhizomnium punctatum	2000M047	3	R	S	D
Rhizomnium punctatum	2001M369	4	R	S	D
Rhizomnium punctatum	2000M091	1	R	V	W
Rhizomnium punctatum	2001H274	4	R	S	W
Rhizomnium punctatum	2001M215	4	R	H	W
Rhizomnium punctatum	2001M380	3	R	H	D
Rhizomnium punctatum	2000M102	4	R	S	W
Rhizomnium punctatum	2001H304	4	R	D	S
Rhizomnium punctatum	2001H264	4	R	D	W
Rhizomnium punctatum	2000M046	3	R	S	D
Rhizomnium punctatum	2000M035	1	R	H	A
Rhizomnium punctatum	2000M052	1	L3	S	W
Rhizomnium punctatum	2001H312	4	R	S	W
Rhizomnium punctatum	2001M348	3	R	S	W
Rhizomnium punctatum	2001H152	4	H	S	M
Rhizomnium punctatum	2001H332	3	R	S	W
Rhizomnium punctatum	2001M285	1	R	S	W
Rhizomnium punctatum	2001H277	4	R	S	A
Rhizomnium punctatum	2001H279	4	R	S	W
Rhizomnium punctatum	2000H033	3	R	S	W
Rhizomnium punctatum	2001H281	4	R	S	W
Rhizomnium punctatum	2001M303	S	L3	S	W
Rhizomnium punctatum	2000M073	3	R	H	W
Rhizomnium punctatum	2000H035	3	R	N	W
Rhizomnium punctatum	2001M184	4	L2	S	D
Rhizomnium punctatum	2001H293	4	R	S	W
Rhizomnium punctatum	2001H326	4	R	D	D
Rhizomnium punctatum	2001H268	4	R	D	W
Rhizomnium punctatum	2001M196	3	R	S	W
Rhizomnium punctatum	2000M074	3	R	V	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Rhizomnium punctatum	2001M396	4	R	S	W
Rhizomnium punctatum	2001M264	3	R	S	W
Rhizomnium punctatum	2000M055	1	R	S	D
Rhizomnium punctatum	2001M188	3	R	H	D
Riccardia multifida	2001H309	2	R	S	A
Riccardia multifida	2001H338	2	L3	H	D
Riccardia multifida	2001H159	2	L1	H	D
Riccardia multifida	2001H337	2	L3	H	D
Riccardia multifida	2000H083	1	R	S	A
Riccardia multifida	2000H054	1	R	D	W
Riccardia multifida	2001H201	3	R	H	A
Riccardia multifida	2000H080	1	R	H	A
Riccardia multifida	2000H079	1	R	S	A
Riccardia multifida	2001H157	2	R	D	W
Riccardia multifida	2001H156	1	L1	H	D
Riccardia palmata	2001H347	2	L3	S	D
Riccardia palmata	2001H351	1	L3	S	W
Riccardia palmata	2001H350	2	L3	S	W
Riccardia palmata	2001H258	4	L3	S	W
Riccardia palmata	2001H302	3	L2	S	W
Riccardia palmata	2001H272	1	R	S	W
Riccardia palmata	2001H228	1	R	S	W
Riccardia palmata	2001H348	1	L3	S	D
Riccardia palmata	2000H104	1	L2	S	D
Riccardia palmata	2001H193	1	L3	S	W
Riccardia palmata	2001M303	4	L3	S	W
Scapania sp.	2000H028	2	R	S	W
Scapania nemorosa	2000M115	2	R	H	W
Scapania nemorosa	2000H061	1	R	S	D
Scapania nemorosa	2000H068	1	R	V	D
Scapania nemorosa	2000H052	1	R	V	A
Scapania nemorosa	2000H060	1	R	V	A
Scapania nemorosa	2000M143	3	R	S	W
Scapania nemorosa	2000M137	2	R	H	C
Scapania nemorosa	2000M096	2	R	S	D
Scapania nemorosa	2001M354	4	R	S	W
Scapania nemorosa	2001H181	3	R	S	W
Scapania nemorosa	2000H056	3	R	S	D
Scapania nemorosa	2001M215	2	R	H	W
Scapania nemorosa	2000H101	2	R	H	W
Scapania nemorosa	2000M082	3	R	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Scapania nemorosa	2000H106	2	R	S	D
Scapania nemorosa	2000M154	3	R	S	D
Scapania nemorosa	2001H314	4	R	S	W
Scapania nemorosa	2000H043	1	R	S	W
Scapania nemorosa	2000H113	2	R	S	W
Scapania nemorosa	2000H111	1	R	S	A
Scapania nemorosa	2001H300	2	R	H	W
Scapania nemorosa	2001M190	2	R	H	W
Scapania nemorosa	2000M061	2	R	H	W
Scapania nemorosa	2001M301	3	L3	S	W
Scapania nemorosa	2000H047	1	R	S	D
Scapania nemorosa	2001M345	2	R	S	W
Scapania nemorosa	2000H105	3	R	S	W
Scapania nemorosa	2001H234	1	R	S	W
Scapania nemorosa	2000H098	1	R	S	W
Scapania nemorosa	2000H102	3	R	S	A
Scapania nemorosa	2001H192	3	S	S	W
Scapania nemorosa	2001H158	2	H	H	W
Scapania nemorosa	2000H058	2	R	S	D
Scapania nemorosa	2000M156	4	R	S	W
Scapania nemorosa	2001M250	3	R	S	M
Scapania nemorosa	2000H099	1	R	S	A
Scapania nemorosa	2000M085	3	R	S	A
Scapania nemorosa	2000H071	1	R	S	W
Scapania nemorosa	2001M191	2	R	H	W
Scapania nemorosa	2001M303	S	L3	S	W
Scapania nemorosa	2000H067	1	R	H	W
Scapania nemorosa	2000M097	2	R	H	W
Scapania nemorosa	2000H130	1	R	S	W
Scapania nemorosa	2001M293	2	R	S	W
Scapania nemorosa	2000M157	4	R	S	W
Scapania nemorosa	2001M196	2	R	S	W
Scapania nemorosa	2000M146	3	R	H	D
Scapania nemorosa	2000H057	1	R	S	D
Scapania nemorosa	2001H193	3	L3	S	W
Scapania nemorosa	2000H115	2	R	S	W
Scapania nemorosa	2001M175	4	L3	S	D
Scapania nemorosa	2000M083	4	R	V	D
Scapania nemorosa	2000M100.1	2	R	H	W
Scapania nemorosa	2000H112	1	R	D	W
Scapania nemorosa	2001M216	3	R	H	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Scapania nemorosa	2001H155	4	R	D	W
Scapania nemorosa	2001H180	3	R	S	W
Scapania nemorosa	2001H246	3	R	S	W
Scapania nemorosa	2000M088	2	R	V	D
Scapania nemorosa	2001M225	4	R	H	D
Scapania nemorosa	2000M153	3	R	S	D
Scapania nemorosa	2001M252	3	R	H	D
Scapania nemorosa	2000H062	3	R	V	D
Scapania nemorosa	2000H065	1	R	H	W
Scapania nemorosa	2001M249	4	R	S	D
Scapania nemorosa	2001M263	4	R	S	D
Scapania nemorosa	2000H096	3	R/H	R	M
Scapania nemorosa	2001H275	3	R	S	W
Scapania nemorosa	2001M183	3	L3	S	W
Scapania nemorosa	2000H059	1	R	S	W
Scapania nemorosa	2000H114	2	R	S	W
Scapania nemorosa	2000H064	1	R	S	D
Scapania nemorosa	2000H105	3	R	S	W
Scapania nemorosa	2000H063	1	R	S	W
Scapania nemorosa	2000M168	3	R	D	D
Scapania nemorosa	2001M245	3	R	S	W
Scapania nemorosa	2001H226	1	R	S	W
Scapania nemorosa	2001H289	3	R	S	W
Scapania nemorosa	2001H238	1	R	S	A
Scapania nemorosa	2000M148	2	R	S	W
Scapania nemorosa	2000M081	3	R	V	W
Scapania nemorosa	2001H164	4	R	H	W
Scapania nemorosa	2001M211	2	R	H	W
Scapania nemorosa	2000M110	4	R	S	D
Scapania nemorosa	2001H218	3	R	S	D
Scapania undulata	2001H213	1	R	S	W
Scapania undulata	2001M212	3	R	H	W
Scapania undulata	2001H165	1	R	S	W
Scapania undulata	2000M049	3	R	S	D
Scapania undulata	2001M188	3	R	H	D
Scapania undulata	2001M236	4	R	S	A
Scapania undulata	2001M261	3	R	S	A
Scapania undulata	2001M233	4	R	S	W
Scapania undulata	2000H063	2	R	S	W
Scapania undulata	2000H048	1	R	S	A
Scapania undulata	2000H061	2	R	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Scapania undulata	2000H097	1	R	S	A
Scapania undulata	2000M130	3	R	H	A
Scapania undulata	2000M054	2	R	S	W
Scapania undulata	2001H161	1	R	S	W
Scapania undulata	2001H162	1	R	S	W
Scapania undulata	2001M388	4	R	S	W
Scapania undulata	2000H033	3	R	S	W
Scapania undulata	2000H038	3	R	S	W
Scapania undulata	2001H212	1	R	S	W
Scapania undulata	2000M100.1	3	R	H	W
Scapania undulata	2001H159	3	L1	H	D
Scapania undulata	2001M286	4	R	S	W
Scapania undulata	2001H183	4	R	H	D
Scapania undulata	2001H174	1	R	H	D
Scapania undulata	2001H158	3	H	H	W
Scapania undulata	2001H194	1	R	S	W
Scapania undulata	2000H052	2	R	V	A
Schistidium rivulare	2001M223	2	R	S	D
Schistidium rivulare	2001H170	4	R	H	W
Schistidium rivulare var. *rivulare*	2001M281	2	R	S	D
Schistidium rivulare var. *rivulare*	2001M358	2	R	S	C
Schistidium rivulare var. *rivulare*	2001M312	2	R	S	W
Schistidium rivulare var. *rivulare*	2001M360	3	R	S	C
Schistidium rivulare var. *rivulare*	2001M318	3	R	S	W
Schistidium rivulare var. *rivulare*	2001H219	2	R	S	D
Schistidium rivulare var. *rivulare*	2001M305	2	R	S	W
Schistidium rivulare var. *rivulare*	2001M314	4	R	S	W
Schistidium rivulare var. *rivulare*	2001H254	3	R	S	W
Schistidium rivulare var. *rivulare*	2001M294	3	R	S	W
Schistidium rivulare var. *rivulare*	2000M072	2	R	H	D
Schistidium rivulare var. *rivulare*	2001M253	1	R	H	D
Schistidium rivulare var. *rivulare*	2001M356	2	R	S	C
Schistidium rivulare var. *rivulare*	2001M377	2	R	D	S
Schistidium rivulare var. *rivulare*	2001M252	2	R	H	D
Schistidium rivulare var. *rivulare*	2001M297	1	R	S	C
Schistidium rivulare var. *rivulare*	2001M375	3	R	H	D
Schistidium rivulare var. *rivulare*	2001M343	1	R	D	W
Schistidium rivulare var. *rivulare*	2001M341	3	R	S	W
Schistidium rivulare var. *rivulare*	2001M295	3	R	S	C
Schistidium rivulare var. *rivulare*	2001M334	1	R	D	W
Schistidium rivulare var. *rivulare*	2001H216	2	R	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Schistidium rivulare var. *rivulare*	2001M328	1	T	S	D
Schistidium rivulare var. *rivulare*	2000M057	2	R	S	D
Schistidium rivulare var. *rivulare*	2001M338	1	R	D	W
Schistidium rivulare var. *rivulare*	2001M292	2	R	S	W
Schistidium rivulare var. *rivulare*	2001H255	3	T	S	D
Schistidium rivulare var. *rivulare*	2000M073	3	R	H	W
Schistidium rivulare var. *rivulare*	2001H215	3	R	S	D
Schistidium rivulare var. *rivulare*	2001M283	1	R	S	D
Schistidium rivulare var. *rivulare*	2000M056	2	R	S	D
Schistidium rivulare var. *rivulare*	2001M282	2	R	S	D
Schwetschkeopsis fabronia	2000M015	1	L2	S	M
Schwetschkeopsis fabronia	2000M023	3	R	S	D
Sciaromium lescurii	2000H126	3	R	S	M
Sciaromium lescurii	2000M134	5	R	S	A
Sematophyllum sp.	2001M295	4	R	S	C
Sematophyllum demissum	2001H268	3	R	D	W
Sematophyllum demissum	2000M085	1	R	S	A
Sematophyllum demissum	2000M157	1	R	S	W
Sematophyllum demissum	2001M276	1	R	S	D
Sematophyllum demissum	2001M275	1	R	H	C
Sematophyllum demissum	2001M355	1	R	S	W
Sematophyllum demissum	2001M237	1	R	H	W
Sematophyllum demissum	2001M341	1	R	S	W
Sematophyllum demissum	2001M342	2	R	D	W
Sematophyllum demissum	2000M056	1	R	S	D
Sematophyllum demissum	2000H130	4	R	S	W
Sematophyllum demissum	2001H178	4	R	S	W
Sematophyllum demissum	2001M313	1	R	S	W
Sematophyllum demissum	2001M193	4	R	H	W
Sematophyllum demissum	2001M225	1	R	H	D
Sematophyllum demissum	2000M103	1	R	H	W
Sematophyllum demissum	2000M161	1	R	S	W
Sematophyllum demissum	2001H176	4	R	H	W
Sematophyllum demissum	2000M102	1	R	S	W
Sematophyllum demissum	2000M165	1	R	S	M
Sematophyllum demissum	2001M339	1	R	D	W
Sematophyllum demissum	2001M373	1	L2	S	D
Sematophyllum demissum	2001M317	1	R	S	W
Sematophyllum demissum	2000M047	1	R	S	D
Sematophyllum demissum	2001H266	3	R	D	W
Sematophyllum demissum	2001H221	3	R	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Sematophyllum demissum	2000M112	1	R	H	W
Sematophyllum marylandicum	2001H182	3	R	S	D
Sematophyllum marylandicum	2001M220	3	R	H	W
Sematophyllum marylandicum	2001M270	3	R	H	D
Sematophyllum marylandicum	2001M188	2	R	H	D
Sematophyllum marylandicum	2001M211	3	R	H	W
Sematophyllum marylandicum	2000M100.1	1	R	H	W
Sematophyllum marylandicum	2001M319	1	R	S	W
Sematophyllum marylandicum	2001M219	1	R	H	W
Sematophyllum marylandicum	2000H062	3	R	V	D
Sematophyllum marylandicum	2001H290	3	R	S	W
Sematophyllum marylandicum	2001M308	1	R	S	W
Sematophyllum marylandicum	2001M303	3	L3	S	W
Sematophyllum marylandicum	2001H164	3	R	H	W
Sematophyllum marylandicum	2000M110	1	R	S	D
Sematophyllum marylandicum	2000M138	1	R	S	W
Sematophyllum marylandicum	2000M143	1	R	S	W
Sematophyllum marylandicum	2000M083	1	R	V	D
Sematophyllum marylandicum	2001M257	3	R	H	W
Sematophyllum marylandicum	2000M106	1	R	S	W
Sematophyllum marylandicum	2000H121	2	R	S	W
Solenostoma sp.	2001H211	1	R	S	A
Solenostoma sp.	2000H086	1	R	H	A
Solenostoma crenuliformis	2000H124	3	R	S	M
Solenostoma crenuliformis	2001H203	1	R	H	A
Solenostoma crenuliformis	2001H201	2	R	H	A
Solenostoma crenuliformis	2000H052	3	R	V	A
Solenostoma crenuliformis	2000H040	1	R	S	W
Solenostoma crenuliformis	2000H075	3	R	H	A
Solenostoma crenuliformis	2001H204	2	R	S	A
Solenostoma obscurum	2000H076	2	R	S	A
Solenostoma obscurum	2000H049	1	R	H	W
Solenostoma obscurum	2000H081	1	R	S	A
Solenostoma obscurum	2000H069	1	R	V	W
Solenostoma obscurum	2001A013	3	R	S	A
Solenostoma obscurum	2000H073	1	R	H	A
Solenostoma pumilum	2001M344	2	R	S	A
Sphagnum flexuosum	2000M044	1	S	S	W
Sphagnum inundatum	2000M093	11	S	S	W
Sphagnum inundatum	2000M084	1	R	V	W
Sphagnum palustre	2001H147	4	S	S	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Sphagnum palustre	2001H144	2	S	S	M
Sphagnum palustre	2001M326	1	H	S	M
Sphagnum palustre	2001M179	1	S	S	M
Sphagnum palustre	2001M321	1	S	S	W
Sphagnum palustre	2000M147	1	H	S	D
Taxiphyllum deplanatum	2001M337	1	R	S	W
Taxiphyllum deplanatum	2000M064	1	L2	N	D
Taxiphyllum taxirameum	2000M066	1	R	V	D
Tetraphis pellucida	2001M248	2	R	S	D
Tetraphis pellucida	2001H143	4	R	N	D
Tetraphis pellucida	2001H149	S	R	S	D
Tetraphis pellucida	2001M172	1	L3	S	D
Thamnobryum alleghaniense	2001M369	2	R	S	D
Thamnobryum alleghaniense	2000M021	2	R	S	M
Thuidium sp.	2001H248	S	R	S	W
Thuidium sp.	2000H027	3	R	R	M
Thuidium delicatulum	2000M059	2	SR	S	D
Thuidium delicatulum	2001H302	3	L2	S	W
Thuidium delicatulum	2000M072	2	R	H	D
Thuidium delicatulum	2001H301	4	R	H	W
Thuidium delicatulum	2001M175	3	L3	S	D
Thuidium delicatulum	2001M184	1	L2	S	M
Thuidium delicatulum	2001M315	3	R	S	W
Thuidium delicatulum	2001M174	3	L3	S	M
Thuidium delicatulum	2000M159	S	R	S	W
Thuidium delicatulum	2001M307	3	R	S	W
Thuidium delicatulum	2001M176	2	L3	S	M
Thuidium delicatulum	2001M321	4	S	S	W
Thuidium delicatulum	2001H279	4	R	S	W
Thuidium delicatulum	2001H181	3	R	S	W
Thuidium delicatulum	2001H332	4	R	S	W
Thuidium delicatulum	2001H331	3	R	S	W
Thuidium delicatulum	2001M397	2	L3	H	D
Thuidium delicatulum	2001M393	4	R	D	S
Thuidium delicatulum	2001M183	4	L3	S	W
Thuidium delicatulum	2000M017	2	L2	S	M
Thuidium delicatulum	2000M094	1	R	V	D
Thuidium delicatulum	2001M392	4	R	S	D
Thuidium delicatulum	2001H305	2	R	S	A
Thuidium delicatulum	2001M372	4	R	D	S
Thuidium delicatulum	2001H277	3	R	S	A

Taxa	Number	Proportion	Substrate	Light	Moisture
Thuidium delicatulum	2001M391	3	R	S	W
Thuidium delicatulum	2001M199	3	H	S	M
Thuidium delicatulum	2000M030	2	L3	H	D
Thuidium delicatulum	2000M095	1	R	V	W
Thuidium delicatulum	2001M173	2	S	S	D
Thuidium delicatulum	2001M293	1	R	S	W
Thuidium delicatulum	2001M197	3	S	H	M
Thuidium delicatulum	2001H296	4	R	S	C
Thuidium delicatulum	2001M202	1	H	H	W
Thuidium delicatulum	2001M191	2	R	H	W
Thuidium delicatulum	2001M303	2	L3	S	W
Thuidium delicatulum	2001M365	2	L2	S	W
Thuidium delicatulum	2001M301	3	L3	S	W
Thuidium delicatulum	2001M330	1	R	S	W
Thuidium delicatulum	2001M177	3	R	S	D
Thuidium delicatulum	2001M331	3	R	S	W
Thuidium delicatulum	2001M366	4	L2	S	W
Thuidium delicatulum	2001M291	3	R	S	W
Thuidium delicatulum	2001M304	4	R	S	W
Thuidium delicatulum	2001H261	4	R	S	W
Thuidium delicatulum	2001M301	S	R	S	W
Thuidium delicatulum	2001M185	2	L2	S	D
Thuidium delicatulum	2001M201	1	H	S	M
Thuidium delicatulum	2000M082	2	R	S	W
Thuidium delicatulum	2001M368	2	R	D	S
Thuidium delicatulum	2001M385	4	R	D	D
Thuidium delicatulum	2001M171	2	S	S	D
Thuidium delicatulum	2001M254	2	R	H	D
Thuidium delicatulum	2001M232	1	R	H	W
Thuidium delicatulum	2001H293	3	R	S	W
Thuidium delicatulum	2001M360	S	R	S	C
Thuidium delicatulum	2001M332	3	R	S	D
Thuidium delicatulum	2000M038	3	L3	H	D
Thuidium delicatulum	2001M347	1	R	S	W
Thuidium delicatulum	2001M358	2	R	S	C
Thuidium delicatulum	2001H252	4	R	S	W
Thuidium delicatulum	2001M386	1	R	D	D
Thuidium delicatulum	2001M406	1	R	S	D
Thuidium delicatulum	2000M109	2	S	S	D
Thuidium delicatulum	2001M198	4	R	S	W
Thuidium delicatulum	2001M300	3	L3	S	W

Taxa	Number	Proportion	Substrate	Light	Moisture
Thuidium delicatulum	2001H155	2	R	D	W
Thuidium delicatulum	2001M333	4	R	S	D
Thuidium delicatulum	2001H312	4	R	S	W
Thuidium delicatulum	2001M371	4	R	S	W
Thuidium delicatulum	2001M404	3	L3	S	D
Thuidium delicatulum	2001H154	3	H	H	W
Thuidium delicatulum	2001H193	4	L3	S	W
Thuidium delicatulum	2001M320	1	R	S	W
Thuidium delicatulum	2000M160	1	S	S	W
Thuidium delicatulum	2001M378	3	R	D	S
Thuidium delicatulum	2000M053	2	S	S	W
Thuidium delicatulum	2000M062	2	S	S	W
Thuidium delicatulum	2001H292	4	R	S	W
Thuidium delicatulum	2001H285	S	T	S	D
Thuidium delicatulum	2001M233	1	R	S	W
Thuidium delicatulum	2001M335	1	R	S	W
Thuidium delicatulum	2001H274	3	R	S	W
Thuidium delicatulum	2001H153	2	H	H	D
Thuidium delicatulum	2001H144	3	S	S	M
Thuidium delicatulum	2001H147	4	S	S	D
Thuidium delicatulum	2001M352	1	R	S	W
Thuidium delicatulum	2001M306	4	R	S	W
Thuidium delicatulum	2001H142	4	S	S	D
Thuidium delicatulum	2001H349	3	R	S	D
Thuidium delicatulum	2001H342	3	R	D	W
Thuidium delicatulum	2001M400	2	L3	S	D
Thuidium delicatulum	2001M403	2	L3	S	D
Thuidium delicatulum	2001H183	3	R	H	D
Thuidium delicatulum	2001H295	4	R	S	W
Thuidium delicatulum	2001H288	2	R	S	W
Thuidium delicatulum	2001H141	4	S	S	M
Thuidium delicatulum	2001H326	4	R	D	D
Thuidium delicatulum	2001M345	3	R	S	W
Thuidium delicatulum	2000M080	3	S	S	W
Tortella sp.	2000M168	3	R	D	D
Tortella humilis	2001M224	1	R	H	D
Tortella humilis	2000M050	2	R	S	M
Tortella humilis	2001M294	2	R	S	W
Tortella humilis	2001H218	3	R	S	D
Tortella humilis	2001H292	4	R	S	W
Tortella humilis	2001M252	2	R	H	D

Taxa	Number	Proportion	Substrate	Light	Moisture
Trichocolea tomentella	2001M368	S	R	D	S
Trichocolea tomentella	2001M402	4	L3	S	D
Trichocolea tomentella	2001H349	2	R	S	D
Trichocolea tomentella	2001H275	3	R	S	W
Trichocolea tomentella	2001M404	3	L3	S	D
Trichocolea tomentella	2001M401	2	L3	S	D
Trichocolea tomentella	2001H342	2	R	D	W
Trichocolea tomentella	2001H142	2	S	S	D
Trichocolea tomentella	2001M179	2	S	S	M
Trichocolea tomentella	2001M321	4	S	S	W
Trichocolea tomentella	2001H144	1	S	S	M
Trichocolea tomentella	2000M147	2	H	S	D
Trichocolea tomentella	2001M173	3	S	S	D
Tritomaria exsecta	2001M268	3	R	S	D
Tritomaria exsecta	2001M193	4	R	H	W
Tritomaria exsecta	2001M194	3	R	S	W
Tritomaria exsectiformis	2001M245	4	R	S	W
Ulota crispa	2000M024	1	L1	S	D
Wessia controversa	2001M240	1	R	H	D

Appendix 3: Taxa list for Falls Branch Falls, Cherokee National Forest, Monroe County, Tennessee.

Mosses	Author
Andreaea rothii	Web. & Mohr
Anomodon attenuatus	(Hedw.) Hub.
Anomodon rostratus	(Hedw.) Schimp.
Anomodon rugellii	(C. M.) Keissl.
Atrichum undulatum	(Hedw.) P-Beauv.
Bartramia pomiformis	Hedw.
Blindia acuta	(Hedw.) BSG
Brachythecium plumosum	(Hedw.) BSG
Brachythecium rivulare	BSG
Brachythecium rutabulum	(Hedw.) BSG
Brachythecium salebrosum	(Web. & Mohr) BSG
Brotherella recurvans	(Mx.) Fl.
Bryhnia novae-angliae	(Sull. & Lesq. *ex* Sull.) Grout
Climacium americanum	Brid.
Cratoneuron filicinum	(Hedw.) Spruce
Ctenidium malacodes	Mitt.
Dicranella heteromalla	(Hedw.) Schimp.
Dicranodontium denudatum	(Brid.) E. G. Britt. *ex* Williams
Dicranum fulvum	Hook.
Dicranum scoparium	Hook.
Dicranum viride	(Sull. & Lesq.) Lindb.
Diphyscium cumberlandianum	Harvill
Ditrichum	Hampe, *nomen conservandum*

Hepatics	Author
Anastrophyllum michauxii	(Web.) Buch
Anastrophyllum minutum	(Schreb. *ex* Cranz) Schust.
Bazzania trilobata	(L.) S. Gray
Blepharostoma trichophyllum	(L.) Dumort.
Calypogeia fissa	(L.) Raddi
Calypogeia muelleriana	(Schiffn.) K. Muell.
Calypogeia sullivantii	Aust.
Cephalozia bicuspidata	(L.) Dumort.
Cephalozia connivens	(Dicks.) Lindb.
Cephalozia lunulifolia	(Dumort.) Dumort.
Cephaloziella byssacea	(Roth.) Warnst.
Chiloscyphus appalachianus	(Schust.) Evans & Schust
Chiloscyphus cuspidatus	(Nees) Eng. & Schust.
Chiloscyphus rivularis	(L.) Corda
Chiloscyphus profundus	(Nees) Eng. & Schust.
Cololejunea biddlecomiae	(Aust.) Evs.
Conocephalum conicum	(L.) Underwood
Diplophyllum apiculatum	(Evans) Steph.
Drapanolejunea appalachiana	Schust.
Frullania asagrayana	Mont.
Frullania plana	Sull.
Harpalejunea ovata ssp. *integra*	Schust.
Harpanthus scutatus	(Web. & Mohr.) Spruce

Mosses	Author
Eurhynchium hians	(Hedw.) Sande-Lac.
Fissidens appalachensis	Zand.
Fissidens bryoides	Hedw.
Fissidens dubius	P. Beauv.
Fontinalis dalecarlica	BSG
Haplohymenium triste	(Ces. ex De Not.) Kindb.
Heterocladium macounii	Best
Heterophyllum affine	(Hook. *ex* Kunth) Fl.
Hookeria acutifolia	Hook. & Grev.
Hygrohypnum eugyrium	(BSG) Loeske
Hygrohypnum luridum	(Hedw.) Jenn.
Hygrohypnum micans	(Hedw.) Loeske.
Hygrohypnum molle	(Hedw.) Loeske.
Hypnum curvifolium	Hedw.
Hypnum fertile	Sendtn.
Hypnum imponens	Hedw.
Hypnum pallescens	(Hedw.) P.-Beauv.
Isopterygiopsis muelleriana	(Schimp.) Iwats.
Isopterygium tenerum	(Sw.) Mitt
Leucobryum albidum	(Brid.) Lindb.
Leucobryum glaucum	(Hedw.) Angstr.
Leucodon julaceus	(Hedw.) Sull.
Loeskeobryum brevirostre	(Brid.) Fleisch. *ex* BSG
Mnium hornum	Hedw.
Mnium thomsonii	Schimp.

Hepatics	Author
Herbertus aduncus ssp. *tenuis*	(Evans) Miller & Scott
Jamesoniella autumnalis	(DeCond.) Steph.
Jubula pennsylvanica	(Steph.) Evans
Jungermannia lanceolata	L. emend. Schrad.
Kurzia sylvatica	(Evans) Grolle
Lejunea laetevirens	Nees & Mont.
Lejunea lamacerina ssp. *geminata*	Schust.
Lejunea ruthii	(Evans) Schust.
Lejunea ulicina ssp. *ulicina*	(Tayl.) Tayl. *ex* G. L. & N.
Lepidozia reptans	(L.) Dumort.
Leucolejunea clypeata	(Schwein.) Evans
Marsupella emarginata	(Ehrh.) Dumort.
Marsupella sphacelata	(Gres.) Dumort.
Metzgeria conjugata	Lindb.
Metzgeria furcata	(L.) Dumort.
Metzgeria leptoneura	Spruce
Nardia lescurii	(Aust.) Underw.
Nowellia curvifolia	(Dicks.) Mitt.
Odontoschisma denudatum	(Nees) Dumort.
Odontoschisma prostratum	(Sw.) Trev.
Pallavacinia lyellii	(Hook.) Gray
Pellia epiphylla	(L.) Lindb.
Plagiochila caduciloba	Blomq.
Plagiochila europhyllon ssp. *echinata*	(Schust.) Inoue
Plagiochila porelloides	Lindenb.

Mosses	Author
Neckera pennata	Hedw.
Oncophorus rauii	(Aust.) Grout
Oxystegus tenuirostris	(Hook. & Tayl.) A. J. E. Smith
Philonotis fontana	(Hedw.) Brid.
Plagiomnium ciliare	(C. Mull.) T. Kop.
Plagiothecium cavifolium	(Brid.) Iwats.
Plagiothecium denticulatum	(Hedw.) BSG
Plagiothecium laetum	BSG
Platyhypnidium riparioides	(Hedw.) Dix.
Platylomella lescurii	(Sull. Ex Gray) Andrews
Polytrichum pallidisetum	Funck
Pseudotaxiphyllum distichaceum	(Mitt.) Iwats.
Pseudotaxiphyllum elegans	(Brid.) Iwats.
Pylaisiadelpha tenuirostris	(Bruch & Schimp in Sull.) Buck
Racomitrium aciculare	(Hedw.) Brid.
Rhizomnium appalachianum	T. Kop.
Rhizomnium punctatum	(Hedw.) T. Kop.
Schistidium rivulare var. *rivulare*	(Brid.) Podp.
Schwetschkeopsis fabronia	(Schwaegr.) Broth.
Sematophyllum demissum	(Wils.) Mitt.
Sematophyllum marylandicum	(C. M.) E. G. Britt.
Sphagnum flexuosum	Dozy & Molk.
Sphagnum inundatum	Russ.
Sphagnum palustre	L.

Hepatics	Author
Plagiochila sullivantii	G. *ex* Evs.
Porella pinnata	L.
Porella platyphylloidea	(Schwein.) Lindb.
Porella wataugensis	(Sull.) Howe
Radula obconica	Sulliv.
Radula sullivantii	Aust.
Radula tenax	Lindb.
Radula voluta	Tayl.
Riccardia multifida	(L.) S. Gray
Riccardia palmata	(Hedw.) Carruth.
Scapania nemorosa	(L.) Dumort.
Scapania undulata	(L.) Dumort.
Solenostoma crenuliformis	(Aust.) Steph.
Solenostoma obscurum	(Evans) Schust.
Solenostoma pumilum	(With.) K. Muell.
Trichocolea tomentella	(Ehrh.) Dumort.
Tritomaria exsecta	(Schmid.) Schiffn.
Tritomaria exsectiformis	(Breidl.) Schiffn.

Hornworts	Author
Megaceros aenigmaticus	Schust.

Mosses	**Author**
Taxiphyllum deplanatum	(Burch. & Schimp. Ex Sull.) Fl.
Taxiphyllum taxirameum	(Mitt.) Fl.
Tetraphis pellucida	Hedw.
Thamnobryum alleghaniense	(C. Mull.) Niewl.
Thuidium delicatulum	(Hedw.) BSG
Tortella humilis	(Hedw.) Jenn.
Ulota crispa	(Hedw.) Brid.
Wessia controversa	Hedw.

VITA

Sarah Marie Noble, the first born of John E. and Mary Noble, was born in Cottonwood, Yavapai County, Arizona on 05 June 1974.

She attended Shenandoah Valley Academy in New Market, Virginia and graduated with an Honors Diploma in 1992. May 1995 she graduated from Anne Arundel Community College where she had studied Horticulture. During 1995 and 1996 she lived and worked in Kaneohe, Hawai'i.

In late 1996 Sarah Marie returned to Arizona to live near her brother, Clinton. In August 1997 she enrolled in Northern Arizona University in Flagstaff, Arizona. While there she became a member of βββ Biological Honor Society and was awarded the Arizona Board of Regents Scholarship in 1998. It was while attending Northern Arizona University that she developed a keen interest in freshwater algae, which eventually lead her interest to bryology. Sarah Marie received a Bachelor of Science in Botany from Northern Arizona University in May 1999.

August of 1999 she moved to Knoxville, Tennessee and began work towards her Master of Science in Botany at the University of Tennessee in Knoxville, Tennessee. While at the university of Tennessee she studied bryology and field botany. She also became a member of ΦΚΦ, a national honor society for multidisciplinary academic excellence. She is planning to graduate from the University of Tennessee in May 2003 with a Master of Science in Botany.